READINGS IN INDUSTRIAL PSYCHOLOGY

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TO OUR TEACHERS

W. V. BINGHAM

AND

A. T. POFFENBERGER

LEADERS IN APPLIED PSYCHOLOGY

PREFACE

In the academic world, apologies are no longer needed for presenting a book of readings in any subject. Anthologies and selections have long flourished in the literary branches of knowledge, and there is ample precedent for kindred ventures in the social sciences. The possible existence of any volume of readings is testimony enough that the field which it represents has attained a reasonable degree of maturity.

Within the last decade, psychologists have had placed at their disposal, for instructional purposes, the catholic collection of Robinson and Robinson in general psychology, the admirably thorough excerpts by Taylor in abnormal psychology, the readable selections of Skinner, Gast, and Skinner in educational psychology, and Young's comprehensive source book for social psychology. The service successfully given by these books warrants an endeavor to compile a similar volume in which the data of industrial psychology are assembled.

We have been guided in the preparation of this book by the following purposes:

1. To provide students in engineering, business administration, and other technical courses with a richer background of that psychological literature which is pertinent to the problems of commerce and industry.

2. To offer to all persons interested in industrial psychology a cross-section of the most significant facts and the best thought available on that theme.

3. To supplement the existing texts in applied psychology which, either through inadequate reference or through voluntary restriction of scope, fail to give a comprehensive picture of the field of industrial psychology.

The execution of this program presupposes the feasibility of gathering together the choicest specimens of a given expert's writings. As is obvious, the greatest obstacle to this end is the difficulty of unifying the isolated items into a coherent sequence. To accomplish this, we have experimented with the location of each excerpt and have written connecting passages which also serve to fill any gaps in the system of ideas. We are painfully conscious of the deficiencies which remain.

The choice of material is a perennial bone of contention. Some of our purple patches may look very gray to others. Perhaps a rough order-of-merit list of the criteria employed during the selective process will reveal, if it does not justify, the motives for choosing the elements finally retained:

1. Basic conceptual contributions
2. Reliability of writer
3. Conciseness of style
4. Adjustment to student level
5. Inaccessibility

It is our hope that no excerpt has been preserved which is not informing and valuable in some way. The apparent exceptions (particularly in the section on character judging) are preserved as edifying monuments of human folly.

To familiarize the novice with the more prominent men who are actively engaged in making significant contributions to industrial psychology, we have included a section of brief biographical notes. The selection of names does not indicate any final evaluation and is certainly not intended to be a *Who's Who* of psychologists.

Careful readers will notice that we have generally avoided direct criticism of viewpoints, faulty experimental or statistical techniques, or irrelevant conclusions. We have preferred to let one reading annul another wherever scientific rectitude or psychological sobriety have been violated. There is no insurance that some persons will not accept every statement simply because it is printed in this book; but it seems reasonable that any one capable of reading it will grasp whatever truth contradictories can yield if he will only persevere to the end.

We make no pretensions that the present work is a contribution to the science of industrial psychology; our sole purpose has been to make more available to both technician and layman what is already known about it. An acquaintance with the elementary facts of general psychology is presupposed, but a brief condensation of the essentials is offered in the first chapter for the benefit of those who need to refurbish their associations or who are bold enough to attack this volume without crossing the preliminary hurdle.

The questions appended to each section formed part of the original mimeographed material which was distributed at appropriate intervals to classes in applied psychology during the academic years 1929-30 and 1930-31. We have profited from our students' recommendations and believe that a judicious use of the problems will evoke as much stimulating discussion and original thinking as it has with us. The inquiries spontaneously made by members of

he course concerning topics treated therein furnished a rich source of suggestions for minor essay items.

Experiments, tests, and statistics constitute the major instruments for conveying the message of this branch of psychology; consequently, tabular materials are conspicuous in the content. Sufficient observational accounts of a qualitative character, however, have been included to counter the charge of biased emphasis.

It is difficult for us to express adequately our obligation to the many authors and publishers who have consented to this fragmentary rearrangement of their productions. Acknowledgments for their generous permissions are hereby made to Messrs. G. Allen and Unwin; American Council of Education; *American Journal of Sociology;* American Telephone and Telegraph Company; American Academy of Political and Social Science; *Annals of Business Economics and Science of Labor;* D. Appleton and Company; Association of National Advertising Managers; the Atlantic Monthly Press; *British Journal of Psychology; Bulletin of the Taylor Society;* Bureau of Personnel Research; Dodd, Mead and Company; Doubleday, Page and Company; E. P. Dutton and Company; *Engineering Education; Factory;* Harper and Brothers; Harvard University Press; Helios Verlag; Henry Holt and Company; Houghton Mifflin and Company; Illuminating Engineering Society; Industrial Fatigue Research Board of Great Britain; *Industrial Psychology; Industrielle Psychotechnik; Iron Age; Journal of Applied Psychology; Journal of Educational Psychology; Journal of Educational Research; Journal of Personnel Research; Journal of the Society of Automotive Engineers;* J. B. Lippincott Company; John W. Luce and Company; McGraw-Hill Book Company; The Macmillan Company; National Society for the Study of Education; W. W. Norton and Company; Oxford University Press; *Pedagogical Seminary; The Personnel Manual; The Personnel Journal; Praktische Psychologie; Psychological Monograph; Psychological Review;* Philadelphia *Public Ledger;* Public School Publishing Company; G. P. Putnam's Sons; *Quarterly Journal of Economics;* The Ronald Press Company; George Rutledge and Sons; *School and Society; The Scientific Monthly;* Charles Scribner's Sons; Thornton Butterworth; U. S. Department of War; University of Chicago Press; D. Van Nostrand Company; Warwick and York; The Williams and Wilkins Company.

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HAROLD E. BURTT (1890–), B.A., Dartmouth; M.A., Ph.D., Harvard. Instructor in psychology, Harvard, Simmons, and Ohio State. Professor of Psychology, Ohio State, 1923–. Consulting psychologist to various firms. In addition to numerous articles on applied psychology, is author of *Principles of Employment Psychology*, 1926; *Psychology and Industrial Efficiency*, 1929.

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Henry Ford (1863–). Was born on a farm near Dearborn, Michigan, where his great automobile manufacturing plant is now located. He went to school until age 15; and at age 16 he apprenticed himself in a machine shop. He built a gasoline motor car which first ran in 1893, and organized the Ford Motor Company in 1903. He is a pioneer in mass production, high wages, and a short working day.

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DWIGHT L. HOOPINGARNER (1893–), B.A., M.A., Texas. Formerly lecturer on labor relations at Harvard, Columbia, and Massachusetts Institute of Technology. Public Relations Council, Beneficial Loan Corporation, New York, since 1929. Author of *Labor Relations in Industry*, 1925; *The Management of Labor*, 1927; and various articles and booklets on labor problems.

J. DAVID HOUSER (1887–), B.A., M.A., Stanford University; graduate study at California and Chicago. Fellow, Wertheim Foundation for the Betterment of Industrial Relationships, Harvard, 1924–1925. President, Pacific Coast Bureau of Management Research, 1919–1924. President, J. David Houser and Associates, 1925–. Research in personnel and public relations. Author of *What the Employer Thinks*, 1927, and various magazine articles on personnel and public relations.

ROBERT F. HOXIE (1868–1918), Ph.B., Ph.D., Chicago. Teacher of economics at Cornell College, Washington University, Washington and Lee University, Cornell University, and University of Chicago. Special investigator of scientific management and labor for United States Commission on Industrial Relations, 1914–1915. Associate Editor, *Journal of Political Economy*. Author of *Scientific Management and Labor*, 1915, and of numerous articles.

CLARK L. HULL (1884–), B.A., Michigan; M.A., Ph.D., Wisconsin. Taught psychology at University of Wisconsin, 1916–1929; Professor of Psychology and Director of the Laboratory, 1925–1929. Professor of Psychology, Institute of Human Relations, Yale University, since 1929. Invented machine for calculating correlations. Author of many articles and of *Aptitude Testing*, 1928.

ELIZABETH B. HURLOCK (1898–), B.A., M.A., Bryn Mawr; Ph.D., Columbia. Instructor, University Extension, Columbia. Author of "An Evaluation of Certain Incentives Used in School Work," and of many articles relating to the effects of incentives on the work of children.

A. W. JACKSON (1898–), Ph.B., Chicago. Joint author of "A Note on the Extent to which Systems of Character Analysis Are Used in the Business World."

JOSEPH JASTROW (1863–), B.A., M.A., Pennsylvania; Ph.D., Johns Hopkins. Born in Poland. Taught psychology at University of Wisconsin, 1888–1927. Lecturer, New School of Social Research. Since 1927 he has devoted his time to lecturing and writing, including articles in newspapers on *Keeping Mentally Fit*. Advisory Editor, *Psychological Review*. Publications include numerous articles and books, the better known being *Fact and Fable in Psychology*, 1900; *The Subconscious*, 1906; *Character and Temperament*, 1915; *The Psychology of Conviction*, 1918.

W. D. KEEFER. Author of "Training Engineers in Safety."

HERBERT G. KENAGY (1892–), B.A., B.S., Missouri; M.A., Minnesota. Fellow in applied psychology, Carnegie Institute of Technology, 1919–1920. Assistant Director, Bureau of Personnel Research, Carnegie Institute of Technology, 1920–1923. Manager, Sales Research Department, Procter and Gamble Company, 1923–1925. Director of Training, Armour and Company, 1925–1927. Assistant Manager, Life Insurance Sales

Research Bureau, 1927–. Co-Author, with C. S. Yoakum, of *The Selection and Training of Salesmen*, 1925.

B. Kern. German investigator. Author of *Wirkungsformen der Übing (Habit Effects of Practice)*, 1930.

Forrest A. Kingsbury (1883–), B.A., Central College; M.A., Yale; Ph.D., Chicago. Teacher of psychology since 1911; University of Chicago since 1920, and Dean of the Colleges of Arts, Literature and Science, 1924–1927. Author of *Psychological Tests in Business*, 1924.

Harry D. Kitson (1886–), B.A., Hiram; M.A., Minnesota; Ph.D., Chicago. Began teaching psychology in 1915; at Teachers College, Columbia University, since 1925. Author of various articles and books, dealing chiefly with advertising and selling, and vocational guidance, including *How to Use Your Mind*, 1916; *The Mind of the Buyer*, 1921; *The Psychology of Vocational Adjustment*, 1925.

Frederick B. Knight, B.A., Boston; M.A., Harvard; Ph.D., Columbia. Professor of Psychology in Education, University of Iowa. Joint author of "Validity of Character Judgments Based on External Criteria," 1924.

Arthur Rex Knight (1903–), A.B., Sydney; M.A., Cambridge. Assistant to the Director of the National Institute of Industrial Psychology and joint editor of the Institute's journal, 1925–1928. Lecturer in psychology, University of St. Andrews, 1928–1929. Anderson Lecturer in Comparative Psychology, University of Aberdeen, Scotland, 1929–. Joint author of *Industrial Psychology*, 1929, and author of various articles on industrial psychology.

Arthur W. Kornhauser (1896–), B.S., Pittsburgh; M.A., Carnegie; Ph.D., Chicago. At University of Chicago since 1921; Assistant Professor of Psychology since 1925. Author of numerous articles on applied psychology, and of *Psychological Tests in Business*, 1924.

Jean M. Lahy (1872–). Director of the Laboratory of Experimental Psychology, University of France; Professor of Applied Psychology, University of Paris; Director of the Laboratory of Psychology, Psychiatric Hospital of Paris. Director of the Laboratory of Psychotechnology for the transportation systems of Paris. Also director of other laboratories and technical adviser to various firms. Author of numerous articles and books, including *Taylor System und die Physiologie der Beruflichen*, 1923; *Quelques resultats de l'orientation professionnelle dans une ecole de la Ville de Paris*, 1925; *La selection des travailleurs: conducteurs de tramways et d'autobus*, 1927.

L. A. Legros. Consulting engineer. Member of the Institution of Civil Engineers, Institution of Mechanical Engineers, Institution of Electrical Engineers, Institution of Automobile Engineers (past President), and Société des Ingénieurs Civils de France. He is an officer de L'Instruction Publique (France), a fellow of University College (London), and a member of the Mechanical Warfare Board (Britain). He has written extensively, and is the author of papers in English and French; *Standardization*; and a monograph on *The Gauging of Cylinders*.

Sam Lewisohn (1884–), B.A., Princeton; LL.B., Columbia. Admitted to New York Bar, 1906. Member of firm of Adolph Lewisohn and Sons, investment bankers, and officer in many other business organizations. Chairman, Board of Directors, American Management Association. Writer and speaker on industrial relations and wage problems. Author of *Can Business Prevent Unemployment*, 1925; *The New Leadership in Industry*, 1926.

Henry C. Link (1889–), B.A., M.A., Ph.D., Yale. Psychologist with

Winchester Repeating Arms Company, 1917–1919; U. S. Rubber Company, 1919–1923; Lord and Taylor Company, 1923–1927. With Gimbel Brothers since 1927 as Director and Assistant to the President. One of the pioneers to use psychological tests successfully in industry. Author of *Employment Psychology*, 1919; *Education and Industry*, 1923.

OTTO LIPMANN (1880–), Ph.D., Breslau. Director, Institute for Applied Psychology, 1906–; Editor, *Zeitschrift für angewandte Psychologie*, 1907–; Editor, *Schriften zur Psychologie der Berufseignung und der Wirtschafteleben*, 1918– Head of Research Division, German Teachers' Association. Author of a very large number of articles and books in German and English on various problems of educational and applied psychology, including *Frageliste zur psychologischer Charakteristik der mittleren Berufe*, 1921; *Psychologie für Lehrer*, 1924; *Psychologen und Schule*, 1920; *Berufseignung, Berufswahl, Berufsratung*, 1922; *Grundriss der Arbeitswissenschaft und Ergebnisse der arbeitswissenschaftlichen Statistik*, 1926.

WALTER LIPPMANN (1889–), B.A., Harvard. Formerly editor of *The New Republic*, and later writer for the New York *World*. Writer for New York *Herald Tribune*. Noted for liberal writings on public affairs. Author of *A Preface to Politics*, 1913; *Liberty and the News*, 1920; *The Phantom Public*, 1925; *Men of Destiny*, 1927; *A Preface to Morals*, 1930; and other books and numerous articles.

H. LOSSAGK. German writer. Author of *Griffeldstudien* (*Lever Investigations*), 1926.

STEWART M. LOWRY (1896–), B.S., M.E., Pennsylvania State College. In charge of wage incentive activities for the Procter and Gamble Companies. Senior co-author, *Time and Motion Study and Formulas for Wage Incentives*, 1927; Author of Alexander Hamilton Institute Report, *Financial Incentives for Factory Workers*, 1931, and numerous technical articles and papers since 1922.

KATHERINE E. LUDGATE (Mrs. Herbert Woodrow), B.A., M.S., Washington; Ph.D., Chicago. Instructor and lecturer in psychology, University of Minnesota, 1921–1926. Joint author of "Blond and Brunette Traits."

WILLIAM MCDOUGALL (1871–), B.A., Cambridge; M.A., Oxford; D.Sc., Manchester. Taught psychology at University of London, 1900–1904; Oxford, 1904–1920; Harvard, 1920–1927. Professor of Psychology and head of the Department of Psychology at Duke University since 1927. Associate Editor, *British Journal of Psychology*, 1906–1920; *Journal of General Psychology*, 1927–; *Journal of Social Psychology*, 1929–. Author of *Introduction to Social Psychology*, 1909; *The Group Mind*, 1920; and numerous other books and articles.

HENRI DE MAN. German liberal writer. Author of *The Remaking of a Mind; The Psychology of Socialism; Joy in Work*.

GRACE E. MANSON (1893–), B.A., Goucher; M.A., Columbia; Ph.D., Carnegie. Investigator for National Research Council Committee on Human Migrations, 1923–1926. Bureau of Business Research and University Committee on Vocational Counsel and Placement, 1926–1930. Associate Professor of Psychology and Assistant Director of Personnel, Northwestern University, 1930–.

HELEN MAROT. Investigator on Child Labor and Industrial Commissions, and writer on these topics. Author of *Handbook of Labor Literature*, 1898; *American Trade Unions*, 1913; *Creative Impulse in Industry*, 1918.

S. B. MATHEWSON, B.S., Georgia Tech., 1904. In charge of installation of trade tests, United States Army camps, 1918. Member of Scott Com-

pany, consultants and engineers in personnel work, 1920–1921. Director of personnel administration, Antioch College, 1921–1927. Secretary-Manager, Springfield (Ohio) Chamber of Commerce, 1929–. Author of *Restriction of Output among Unorganized Workers*, 1931; and co-author of *Personnel Management*, revised edition, 1931.

H. B. MAYNARD. Collaborator on *Time and Motion Study*, 1927.

ELTON MAYO. Professor of Industrial Research, Harvard University. Research Associate, Department of Industrial Research, University of Pennsylvania, 1922–1925.

FRANKLIN J. MEINE (1896–), Ph.B., Chicago; M.A., Carnegie. Head of the Department of Personnel Research, Dennison Manufacturing Company, 1919–1920. Chief writings are: *Job Specifications*, 1919; *Personnel Relations: A Functional Conception from the Point of View of the General Manager*, 1929; *Introduction and Development of the Works Committee in the Dennison Manufacturing Company*, 1921.

G. H. MILES, D.Sc. Assistant Director, National Institute of Industrial Psychology. Author of many books and articles, including *The Will to Work*, 1929.

JOHN MILLS (1880–), B.A., Chicago; M.A., Nebraska; B.S., Massachusetts Institute of Technology. Instructor in physics and engineering at various universities, 1901–1911. Engineering, personnel, and publicity work in American Telephone and Telegraph Company or its subsidiaries since 1911. Author of books on physics and engineering, and of articles on personnel work. Inventor of several methods for wire and radio telephoning.

WALTHER MOEDE (1888–), Ph.D., Technische Hochschule zur Berlin. At the Berlin Technical School since 1919 as Professor and Manager of Institute for Industrial Psychotechnics and Work Methods. Psychotechnical expert for the German railways. Editor, *Industrielle Psychotechnik*. Author of numerous publications on applied psychology and psychotechnics, including *Die Experimental psychologie im Dienste des Wirtschaftslebens*, 1919; *Experimentelle Massenpsychologie*, 1920; *Lehrbuch der industriellen Psychotechnik*, 1929.

R. B. MONTGOMERY, Bachelor's degree, University of Wisconsin; M.D., Rush. A practicing physician in Wisconsin. Joint author of "An Experimental Investigation of Certain Alleged Relations between Character and Handwriting."

BRUCE V. MOORE (1891–), M.A., Indiana; Ph.D., Carnegie. Taught psychology at Pennsylvania State College since 1920; Professor of Psychology since 1928. Research Associate, Personnel Research Federation, 1927–1928. His work is chiefly in applied psychology and personnel problems. Author of *Personnel Selection of Graduate Engineers*, 1921; and joint author of *How to Interview*, 1921.

JOHN J. B. MORGAN (1888–), B.A., Taylor; M.A., Ph.D., Columbia; B.D., Drew. Taught psychology at Princeton, Minnesota, and Iowa since 1916. Associate Professor of Psychology at Northwestern since 1925. Conducting research in effect of noise on human organisms. Author of *The Psychology of Abnormal People*, 1928, and of other books and numerous articles.

FRED A. MOSS (1893–), B.A., Mercer; M.A., Columbia; Ph.D., M.D., George Washington. Director of Tests and Standards, United States Army, 1920–1921. Taught psychology at George Washington University since 1921; head of Department of Psychology since 1925. Staff Psychologist, Gallinger Municipal Hospital, 1923–, and Bureau of Public Personnel Ad-

ministration, 1924–1925. Associate Editor, *Public Personnel Studies*, 1924–1925; *Journal of Industrial Psychology*, 1926–1927. Author of *Applications of Psychology*, 1929.

EDWARD L. MUNSON (1868–), B.A., M.A., M.D., Yale. A surgeon in the United States Army since 1898, with the rank of Brigadier General since 1918. Noted for work in hygiene, sanitations, and preventive medicine in the Army and the Philippines. Chief of Morale Branch of General Staff, 1918. Author of many articles and books on military hygiene. Inventor of several articles of equipment now in use in the United States Army.

HUGO MUNSTERBERG (1863–1916), Ph.D., Leipzig; M.D., Heidelberg. This German-American psychologist and philosopher began his teaching at Freiburg, but through the influence of William James went to Harvard in 1892, where he later became Chairman of the Department of Philosophy. He is author of numerous writings in both German and English, including *Gründzüge der Psychologie*, 1900; *Gründzüge der Psychotechnik*, 1914; *Psychology and Industrial Efficiency*, 1913; *Psychology, General and Applied*, 1914; *The Eternal Values*, 1909.

BERNARD MUSCIO (1887–), B.A., Sydney; B.A., Cambridge. Investigator, Industrial Fatigue Research Board, 1919–1922. Author of various articles, especially reports of investigations in industrial fatigue published by the Industrial Fatigue Research Board.

CHARLES S. MYERS, B.A., M.B., B.Ch., M.A., M.D., D.Sc., Cambridge. Professor of Psychology, University of London, 1903–1907; Cambridge, 1904–1922. Consulting psychologist with Armies in France, 1914–1919. Director of National Institute of Industrial Psychology since 1921. Editor, *British Journal of Psychology*, 1911–1924. He has held the highest position in various scientific organizations. Author of many articles and books on pure and applied psychology, including *A Textbook of Experimental Psychology*, 1909; *Mind and Work*, 1921; *Industrial Psychology in Great Britain*, 1925. Many of his earlier writings are on ethnology and on the psychology of music.

GARRY C. MYERS (1884–), B.A., Ursinus; Ph.D., Columbia. Head of the Department of Psychology, Cleveland School of Education, 1920–; Lecturer in Child Psychology, Western Reserve University, 1924–; head of the Division of Parental Education, Cleveland College, 1925–. Author of *Diagnostic Tests in the Fundamental Operations*, 1926, and other articles on pure and educational psychology.

ETHEL MAY NEWBOLD (1882–). Educated at Newnham College, Cambridge University; M.A., Trinity College, Dublin. D.Sc., London. On staff of Medical Research Council, 1919–1929. Fellow, Member of the Council, and holder of the Guy Medal of the Royal Statistical Society. Author of "A Contribution to the Study of the Human Factor in the Causation of Accidents," "Practical Applications of the Statistics of Repeated Events, Particularly to Industrial Accidents," and other papers and joint papers published by the Medical Research Council.

HOWARD K. NIXON (1895–), B.A., Earlham; Ph.D., Columbia. On the staff of Columbia University since 1922. At present, Assistant Professor of Advertising, School of Business, Columbia. Chief research, "Attention to Advertisements." Author of *Psychology for the Writer*, 1928; *Principles of Selling*, 1931.

ETHEL E. OSBORNE. English investigator. Joint author of "Two Contributions to the Study of Accident Causation," 1922.

ARTHUR S. OTIS (1886–), B.A., M.A., Ph.D., Stanford. As development

specialist on tests in the United States War Department, he had a large part in the making of the Army Alpha and other tests used during and following the War. Designer of the well-known Otis tests. Editor of tests and mathematics for the World Book Company. Author of *The Making of a Classification Test*, 1924; *Statistical Method in Educational Measurements*, 1925.

CARLETON PARKER (1878–1918). After graduating from the University of California, he studied economics in Europe. While studying labor problems, he became interested in the psychology of motives and did much to replace the older concept of the economic man with the newer concept of human nature dominated by instincts and compensations for thwarted tendencies. Head of the Department of Economics and Dean of the School of Business Administration, University of Washington.

FRANK A. PARSONS (1868–), B.S., Columbia. Studied art in Italy, France, England, and Austria. President and Director of New York School of Fine and Applied Arts since 1905. Professor of Advertising Display, New York University, since 1915. Lecturer on art in many clubs and associations in thirty-eight states. Author of *Principles of Advertising Arrangement*, 1912; *The Art Appeal in Advertising Display;* and other publications.

DONALD G. PATERSON (1892–), B.A., M.A., Ohio State. Psychological examiner, United States Army, 1917–1919. Consulting psychologist, the Scott Company, 1919–1921. University of Minnesota since 1921; Professor of Psychology since 1923. Associate Editor, *Mental Measurements Monographs*, 1925–. With Rudolf Pintner he prepared a scale of performance tests, commonly known as the Pintner-Paterson tests. Author of *Preparation and Use of New-Type of Examinations*, 1925.

TOM H. PEAR (1886–), B.S., London; M.A., Manchester. Member of Scientific Committee, Industrial Fatigue Research Board and of National Institute of Industrial Psychology. Publications include *Remembering and Forgetting; Skill in Work and Play; Fitness for Work.*

G. A. PENNOCK. Assistant Works Manager, Hawthorne Works, Western Electric Company, Chicago.

ALBERT T. POFFENBERGER (1885–), B.A., D.Sc., Bucknell; M.A., Ph.D., Columbia. Has taught psychology at Columbia since 1912; Professor of Psychology since 1927. Associate Editor, *Journal of Social Psychology.* Author of *Applied Psychology*, 1917; *Psychology in Advertising*, 1925; and numerous articles in general and applied psychology.

WALTER N. POLAKOV (1879–), M.E., Royal Institute of Technology, Dresden; special course in psychology and industrial hygiene, University of Moscow. Born in Russia and came to the United States in 1906. Consulting Engineer for City of New York, 1909–1910. Power Expert, United States Shipping Board, 1918. President, Walter N. Polakov & Co., Inc., industrial consultants; President, American Engineering and Sales Corporation. Author of *Mastering Power Production*, 1920; *Foremanship*, 1923; *Man and His Affairs*, 1925.

ARTHUR POUND (1884–), B. A., Michigan. Writer and journalist. Formerly editorial writer for New York *Evening Post* and New York *Herald*, and contributor of "Iron Man" papers to *Atlantic Monthly*. Associate Editor of the *Independent* since 1924. Author of *The Iron Man in Industry*, 1922.

GLENN CHESNEY QUIETT (1895–), B.A., Reed; Student, Harvard, 1918. On staff, *Survey*, 1920–1921. Newspaper work for Portland *Morning Oregonian*, Tacoma *Daily News*, New York *Evening Post*. Editorial Di-

rector, Tamblyn and Brown, Inc., New York. Associated with Ginn and Company since 1921. Chief work supervision of national publicity campaigns, mainly in connection with raising money. Author, with Ralph D. Casey, of *Principles of Publicity*, 1925.

L. Ramsey. Joint author of "A Study in Vocational Guidance."

Gertrude Rand (1886–), B.A., Cornell; M.A., Ph.D., Bryn Mawr. Taught psychology at Bryn Mawr, 1913–1928; Associate Professor, Research Ophthalmology, 1928–. Author of many articles on vision and illumination, many of them with her husband, C. E. Ferree.

H. Reinhardt. Author of *Rhythmus und Arbeitsleistung* (Rhythm and Performance), 1926.

Stuart A. Rice, B.A., M.A., Ph.D., Columbia. Instructor and Assistant Professor of Sociology, Dartmouth, 1923–1926. Professor of Sociology, 1926. Professor of Sociology and Statistics and Chairman of the Department of Economic and Social Statistics, University of Pennsylvania, 1930. Between 1912 and 1920 held various administrative positions in social work, including that of Superintendent of the New York Municipal Lodging House, in which he had numerous intimate contacts with problems of labor. Author or editor of *Farmers and Workers in American Politics*, 1924; *Quantitative Methods in Politics*, 1928; *Statistics in Social Studies*, 1930; *Methods in Social Science*, 1931. A number of his periodical writings have been in the field of industrial psychology or related to this field.

F. J. Schlink. Technical Director and Engineer-Physicist of Consumers' Research, Inc., New York City. Joint author of *Your Money's Worth*, 1927.

Walter Dill Scott (1869–), B.A., Northwestern; Ph.D., Leipzig; LL.D., Cornell College. Associate Professor of Psychology and Education, Northwestern University, 1901–1908; Professor, 1908–1920. Director of Bureau of Salesmanship Research, Carnegie Institute of Technology, 1916–1917. Colonel, United States Army, 1918–1919. President of Northwestern University since 1920. Awarded D.S.M. for devising, installing, and supervising personnel system in the United States Army. Author of *Psychology of Advertising; Science and Common Sense in Working with Men; Personnel Management; Increasing Human Efficiency;* and many other books and articles.

Charles M. Sheaffer (1858–), Pittsburgh Central High School, 1874. Entered the service of the Pennsylvania Railroad in 1877 and was continuously with that organization in many capacities from office messenger to Assistant Vice-President of Operation until his retirement in 1928 under the company's pension regulations. Author of "Efficiency Tests of Pennslyvania Railroad Personnel."

William H. Sheldon (1899–), B.A., Brown; M.A., Colorado; Ph.D., Chicago. Assistant Professor of Psychology, University of Wisconsin, since 1927.

George H. Shepard, United States Naval Academy, 1891; M.M.E., Cornell, 1902. Lieutenant Commander (Retired), United States Navy, Engineer Corps. Professor of Industrial Engineering and Management, Purdue University, 1919–. Chairman, Gilbreth International Committee on Fatigue, Society of Industrial Engineers, and National Director of the Society. Author of *Application of Efficiency Principles*, 1917; *Elements of Industrial Engineering*, 1928; and of numerous papers and monographs.

Charles S. Slocombe, B.S., New Zealand; Ph.D., London. Research Associate, Columbia, 1926–1927. Personnel Research Federation chief in-

vestigator in the cause and prevention of accidents for the Boston Elevated Railways since 1927.

ADAM SMITH (1723–1790). Studied in Glasgow and Oxford. At first a lecturer on rhetoric at Edinburgh, where he became an intimate friend of David Hume, the philosopher. Professor of Moral Philosophy at Glasgow, 1752–1763. He gave ten years (1766–1776) to his great work, *Inquiring into the Nature and Causes of the Wealth of Nations*. In this he set forth the idea that the manual labor of a nation is the source of its necessaries and conveniences of life. He also advocated freedom of trade.

ELLIOTT DUNLAP SMITH, M.A., LL.B. Formerly Personnel Manager and Division Manager (manufacturing), Dennison Manufacturing Company. Professor of Industrial Engineering at Yale University since 1928.

M. SMITH. Joint author of "A Study in Vocational Guidance."

WINIFRED SPIELMAN (Mrs. Raphael) (1898–), B.S., London. Investigator, National Institute of Industrial Psychology, London, 1922–. Author of various articles on vocational tests.

G. J. STEGEMERTEN (1892–). With the Westinghouse Electric and Manufacturing Company since 1909, being Superintendent of Time Study since 1926. Author of articles on wage incentives. Collaborator on *Time and Motion Study*, 1927.

EDWARD K. STRONG, JR. (1884–), B.S., M.S., California; Ph.D., Columbia. At Carnegie Institute of Technology as Professor and head of the Department of Vocational Education, 1919–1921; head of the Bureau of Educational Research, 1921–1923; Professor in School of Life Insurance Salesmanship, 1919–1923. At Stanford University since 1923; Professor of Psychology, Graduate School of Business, since 1925. Coöperating editor, *Journal of Applied Psychology*, 1917. He has written on many phases of psychology, especially learning, advertising and selling, and vocational guidance. Author of *Effects of Hookworm Disease on the Mental and Physical Development of Children*, 1916; *Introductory Psychology for Teachers*, 1920; *Job Analysis and the Curriculum*, 1923; *Psychology of Selling and Advertising*, 1925. Editor, *Personnel System of the United States Army*, 1919.

MARY STUART. Author of *A Comparison of Speed with Accuracy in the Learning Process*, 1921.

JOHN J. SWAN. M.E., E.E., Cornell University. Member of the American Society of Mechanical Engineers; Committee on Classification of Personnel, United States Army. Author of *Trade Specifications and Occupational Index—U. S. Army*. Also author of sections of *Management Handbook* and various articles in trade journals on labor problems.

FRANK W. TAUSSIG (1859–), B.A., M.A., Ph.D., Harvard. Has also honorary degrees from many universities. Instructor and Professor of Political Economy at Harvard University since 1882. Chairman, United States Tariff Commission, 1917–1919. Author of *Tariff History of the United States*, 1888; *Wages and Capital*, 1896; *Inventors and Money-Makers*, 1915; *International Trade*, 1927; Editor, *Quarterly Journal of Economics*.

FREDERICK W. TAYLOR (1856–1915), M.E., Stevens Institute; D.Sc., Pennsylvania; LL.D., Hobart. Midvale Steel Company, 1878–1889. Organized the management of the manufacturing establishment of many large companies, such as the Bethlehem Steel Company and the Cramp Shipbuilding Company. Inventor of Taylor-White process of treating modern high-speed tools, and received patents for about one hundred inventions. Author of *Art of Cutting Metals*, 1906; *The Principles of*

Scientific Management, 1911; *Shop Management*, 1911. Winner of lawn tennis championship, 1881. The Taylor Society is named in his honor.

ORDEAY TEAD (1891–), B.A., Amherst. In charge of employment management courses for War Department at Columbia University, 1917–1918. Lecturer in personnel administration, Columbia. Formerly member of Department of Industry, New York School of Social Work. Director of Business Publications, McGraw-Hill Company, 1920–1925. Editor of economic and business books, Harper and Brothers, since 1925. Author of *Instincts in Industry*, 1918; *Personnel Administration*, with H. C. Metcalf, 1926; *Human Nature and Management*, 1929.

EDWARD L. THORNDIKE (1874–), B.A., Wesleyan; B.A., M.A., Harvard; Ph.D., Columbia. Teacher and leader in psychological research at Teachers College, Columbia University, since 1899; Professor and Director of the Division of Psychology, Institute of Educational Research, since 1922. As a student of William James, he began the study of animal learning. His investigations in the psychology of learning and the measurement of individual differences have contributed much to educational theory and practice. Author of many books and articles, including *The Human Nature Club*, 1900; *Educational Psychology*, 1903, 1913; *Elements of Psychology*, 1905; *Introduction to the Theory of Mental and Social Measurements*, 1913; *Adult Learning*, 1928.

LOUIS L. THURSTONE (1887–), M.E., Cornell; Ph.D., Chicago. Assistant to Thomas A. Edison, 1912. Professor and head of the Department of Psychology, Carnegie, 1915–1923. Psychologist of the Bureau of Public Personnel Administration, 1923–1924. Professor of Psychology, University of Chicago, since 1924. He has devised many tests, including tests of aptitude for engineering. Author of *The Fundamentals of Statistics*, 1924; *The Nature of Intelligence*, 1924.

HERBERT A. TOOPS (1895–), B.A., B.S., M.A., Ohio State; Ph.D., Columbia. National Research Council, Army Trade Test Division, 1918–1919. Vocational Specialist at Camp Grant, 1920–1921. Research Associate, Institute of Educational Research, Columbia University, 1921–1923. Assistant Professor of Psychology, Ohio State University, 1923-1925; Professor of Psychology, 1926. Author of a large number of articles, particularly in tests and statistical methods. Joint author of *Minnesota Mechanical Ability Tests*.

V. H. VARTANIAN. Joint author of "The Letter of Application in Vocational Selection."

HORACE M. VERNON (1870–), M.A., M.D., Fellow of Oxford, 1898-1920. Investigated the conditions of efficiency and fatigue in munitions workers, 1915–1918. Formerly lecturer in chemical physiology at Oxford. Investigator, Industrial Fatigue Research Board. Author of *Industrial Fatigue and Efficiency*, 1921; *The Alcohol Problem*, 1928; and many other publications on efficiency and fatigue.

MORRIS S. VITELES, B.A., M.A., Ph.D., Pennsylvania. Assistant Professor of Psychology, University of Pennsylvania, 1918–. Has acted as consulting psychologist for numerous firms, including the Milwaukee Electric Railway and Light Company, the Transportation Management Corporation, and the Philadelphia Electric Company. He has devised various tests, including those designed to select motormen and substation operators, and has developed a number of industrial training programs. Author of many articles on psychology in industry.

CLIFFORD G. WARNER (1902–), B.S., London. On staff of Industrial Health Research Board, Medical Research Council, London, since 1921.

FRANK WATTS. University of Manchester, England. Author of "The Construction of Tests for the Discovery of Vocational Fitness."

JAMES D. WEINLAND, B.A., M.A., Pomona; Ph.D., Columbia. Instructor in Business Psychology, New York University. Author of "Variability of Performance in the Curve of Work."

HUGO WESTERBERG. Character analyst, with office in Chicago. Author of *Systems of Character Reading.*

H. C. WESTON. On staff of Industrial Health Research Board of Great Britain. Joint author of report, "On the Design of Machinery in Relation to the Operator."

ISADORE B. WHITLEY (Mrs. F. E. Bowser), Joint author, with W. W. Charters, of *Analysis of Secretarial Duties and Traits.*

WHITING WILLIAMS (1878–), B.A., M.A., Oberlin. Personnel Director and Vice-President, Hydraulic Steel Co., 1918–1920. Laborer in coal mines, steel plants, and other industries in the United States and Europe, 1919–1923, in order to gain first-hand information of workers' point of view. Lecturer on labor and management problems at Harvard and Dartmouth. Counsel in industrial and public relations. Author of *What's on the Worker's Mind,* 1920; *Full Up and Fed Up,* 1921; *Mainsprings of Men,* 1925.

HILDA M. WOODS (1895–), Fellow, Royal Statistical Society. Assistant Lecturer, Division of Epidemiology, London School of Hygiene. Author with Prof. Greenwood, of "The Incidence of Industrial Accidents," 1919; "Statistical Studies of Scarlet Fever, Diphtheria and Pneumonia," 1925, 1927, 1929; "An Introduction to Medical Statistics" (with Mr. Russell), 1931.

STANLEY WYATT (1890–), M.S., M.Ed., Manchester. General Lecturer in Education, Pretoria Normal College, South Africa. Senior investigator, Industrial Health Research Board, 1919. Special lecturer in psychology, University of Manchester. Author of numerous reports of the Industrial Health Research Board and articles in the *British Journal of Psychology.*

C. P. YAGLOGLOU. Author of "Modern Ventilation Principles and their Application to Sedentary and Industrial Life."

CLARENCE S. YOAKUM (1879–), B.A., Campbell; Ph.D., Chicago. Professor and head of Department of Philosophy and Psychology, Texas, 1908–1917. Professor of Applied Psychology and Director of the Bureau of Personnel Research, Carnegie, 1919–1924. Professor of Personnel Administration, Michigan, 1924–1929. Dean of School of Liberal Arts, Northwestern, 1929–1930. Vice-President and Director of Educational Investigations at University of Michigan, 1930. Managing Editor, *Personnel Journal,* 1922. Author of *Army Mental Tests,* 1920; *Selection and Training of Salesmen,* 1925; *Psychological Foundations of Management,* 1927.

D. L. ZYVE. Author of "A Test of Scientific Aptitude."

INTRODUCTION

Doctor L. P. Jacks, eminent English philosopher, in his work on *Constructive Citizenship,* has staked the continuance and sure upbuilding of our present industrial civilization on a realization of the importance of skill, trusteeship, and the application of the scientific method to all phases of human endeavor. The spirit of an industrial organization is built up to the highest degree when each member of it holds his obligation to his fellow workers as a sacred trust. Trusteeship is the term which embodies that obligation and which finds its expression in faithful service between the employer and the employed, between the leader and the led, between management and men; and it is given concrete expression in the wise solution of problems in human relationships.

Recently the board of directors of one of America's greatest industrial enterprises drastically reduced dividends, lowered the salaries of the management group, and maintained the wages of the workers at the going rate. Here is evidence of a new and growing social consciousness, wherein the burdens of a depression are distributed where they can best be borne—an exemplification of the spirit of trusteeship in its broadest aspects.

In closer view, as in selection and training, where provision has been made for the worker's development and growth and the satisfaction of his urge for progress, so in the fields of employee representation, benefits, pensions, thrift, medical service, and similar activities, does industrial leadership contribute to the well-being and security of the employee and thus discharge its trust. This spirit of trusteeship should pervade the whole atmosphere of the working environment, expressed in fair dealings and skillful leadership.

The lasting satisfactions of life come out of work well done, work performed skillfully, manfully. All difficulties in life can be surmounted through the application of skill, which is wisdom in action. This concept has deep expression in the solution of the personnel problems in industry today. All of the undertakings having to do with selection and training have as their chief objective the development of skill. Through right selection, the man finds himself placed in a position fitted to his aptitude, ability, and capacity, and is ready for the development of his skill to the highest pitch of excellence. Training gives him opportunity for

the development of that skill and the satisfactions that come from full accomplishment.

The scientific method is all-comprehensive in its application to the problems of industry. No mention need be made here of its importance in relation to material things, which has long been recognized by industry, but now we are beginning to realize that the scientific method enters vitally into the problem of human relationships. Nothing can contribute more satisfaction to the individual than to be a member of an organization in which the whole human structure has been built up on a sound scientific basis clearly defining the duties and responsibilities of individuals, the definite contribution which each of them makes to the objective of the business, and correct interrelationships among them.

To indicate what is meant by the scientific method through a few illustrations, we must study turnover to discover the reasons for separations, to relate them to causes of dissatisfaction, so that we can remove these causes. Intensive study should be given to age distribution in its relationship to benefits and pensions. Careful and continuous consideration and checking must be given to the worker's training, development, increased responsibilities, length of service, and the relationship of these factors to his progress and well-being.

The continuing development of job analyses and a study of them will give basis for more accurate evaluation of the contribution each job holder makes to the whole, and thus form a basis for better wage and salary differentials. The importance of a scientific development of the selection process on a firm psychological basis is evident. The scientific method as a tool for the development of right human relationships has to do with measurements—a determination and an analysis of the facts and a synthesis that will lead to right conclusions. In no realm of human endeavor is it more important to be right than in our dealings with the human element in industry.

Manifestly, the social science which is basic to the development of the scientific method in human affairs is psychology. It permeates every activity and concept suggested in the foregoing brief discussion. The growing demand for the application of psychological principles to industrial relations has in recent years stimulated investigation, research, and the development of scientific methods and procedures on the campuses of universities and in industrial plants. The literature on industrial psychology has already grown to great volume, and even now it is difficult for student, faculty, and industrialist to keep abreast of this growing body of knowledge.

Professors Moore and Hartmann have owing to them a debt of gratitude from all who are actively interested in industrial psychology. In their *Readings* they have gathered together within easy compass the best work of the most authoritative contributors to this field. Students planning careers in business and industry have here a complete orientation on the fundamental applications of industrial psychology and, if they pursue the courses, will enter business with a keen realization of the importance of problems in human relationships. To the busy industrialist, this volume will be invaluable, used as a check on best practices in industrial relations. The reading selections are arranged in a logical sequence and continuity, keeping all subjects in proper balance, and no small part of the value of the work comes from the personal contributions of the editors. Man power is the life of industry. These *Readings* show how the application of this power can be made more effective.

R. I. REES

The definition of engineering which expresses the thought of the profession today is: "Engineering is the science of controlling the forces and utilizing the materials of nature for the benefit of man, and the art of organizing and directing human activities in connection therewith." The twentieth century addition to the definition of one hundred years ago is in the words, "and the art of organizing and directing human activities in connection therewith."

L. P. ALFORD, *Engineering Education.*

READINGS IN INDUSTRIAL PSYCHOLOGY

CHAPTER I

INTRODUCTION

A. The Field of Industrial Psychology

Industrial psychology is a science which takes as its subject matter the mental life and behavior of men engaged in the work of manufacturing marketable goods and services. Concerned as it is with certain *personal* aspects of production, distribution, and consumption, industrial psychology is intimately allied with many branches of economics. Its studies of the factors making for efficiency bring it into close contact with most phases of engineering, the comprehensive aim of which is to utilize natural and *human* resources for social well-being, despite the universal neglect, until comparatively recent times, of the latter element.

The thoughtful observer of contemporary scientific affairs must have noticed the gradual dissolution of the artificial barriers between different realms of knowledge. There is considerable traffic over the borders of all disciplines. The genuine value inhering in such interrelations is recognized in the dictum that the ablest scientist in any specialty is often the one who knows most about some other subject beside his own. Industrial psychology illustrates this trend perfectly in its associations with physiology and hygiene, management devices, and major social issues. Consequently, it is a little absurd to demand a precise definition of the term and a delimitation of its field at the outset: such a result is to be sought rather as the final product than as an initial vantage point.

It should always be emphasized that industrial psychology is simply *one* form of applied psychology and not coextensive with it. Applied psychology, to be sure, has already acquired the connotation of *practical* psychology, i.e., the employment

of psychology in the service of everyday affairs as distinct from the academic, the occasional, and the remote interest in human conduct. But logically and actually, educational and clinical psychology are genuine applications of laboratory findings, and at present both are far more developed than their industrial brother.

The relation of industrial psychology to what is known as business psychology calls for special comment. The latter term is generally understood to include advertising and selling, testing procedures for office and clerical staffs, and whatever psychological events occur in the exchange, transfer, and utilization of commodities or services. Since business and industry are so firmly linked it seems unwise to stress the distinction between their psychological counterparts. The harmony (or frequent discord!) of supply and demand gives ample testimony to this claim. For the purpose of this volume, therefore, business activities will be viewed as a subdivision of industrial enterprise. It must be admitted, however, that although business psychology is logically made a subdivision of industrial psychology here, its own literature is so extensive that only a small portion can be included in this volume.

In all sciences, it is axiomatic that there can be no practical applications until the fundamental theoretical bases have been laid. The sin of prematurity attaches to all endeavors to work in opposition to this principle. It is this consideration that ensures the priority of pure over applied research. There is no need to offer an opinion on the relative merits of pure versus applied science, for this perennial controversy will remain indecisive because of variations in temperament or terminology. Priority here means simply earlier in time and carries with it no suggestion of superior value. By a parity of reasoning, all the facts of pure psychology possess a potential or deferred value for applied psychology. Even as a youth finds it profitable to purchase an annuity for his old age, so likewise will industrial psychology benefit by its encouragement and support of laboratory investigations.

Just as biochemistry aims to account for physiological processes in terms of known chemical laws without, as a rule, introducing any new causal factors due to the presence of a living body of cells and tissues, so industrial psychology seeks to in-

terpret rationally the rôle of mind in occupational affairs by using available attitudes, contents, and techniques of general psychology. Convenience often dictates a modification of the topical sequences of general psychology, a step amply justified by recent tendencies in this fundamental science. The traditional labels or chapter headings in textbooks such as "memory," "perception," and "imagination," cast as they are in noun form, convey a suggestion of substantiality that is misleading. There is no such entity in the biological world as "memory"; there is only an organism that "remembers." The use of the verbal or participial parts of speech emphasizes the active processes of the organism, as opposed to the static character of the older terminology. Any further apology for the use of functional rather than traditional categories in the material which follows seems unnecessary.

B. Backgrounds of Industrial Psychology

Considering its extraordinary recency, the origins of industrial psychology are strangely obscure. We have no definite date for its beginning such as the opening of Wundt's Leipzig laboratory in 1879, which marked the establishment of modern experimental psychology. As a derived science it had to wait its inception until its fundamental or pure science was reasonably well organized. Furthermore, when it did make its appearance it was masked by a different name and its own nature remained unrecognized by contemporaries.

New divisions of an older subject appear either because of internal expansion or because the personal desires of an investigator lead him to stake out a fixed claim for his independent enterprise. Occasionally, too, the pressure of public demand—with the corresponding social rewards that meeting it entails—suffices for the inauguration of a new movement. Unquestionably, the rapid increase in the number of college courses offered in industrial psychology is attributable to this last influence. The principle of supply and demand obviously affects scientific productivity as well as other fields of human behavior. Whether or not this be a desirable feature must be left to the speculative ethicist for consideration; psychology as psychology steadfastly refuses to commit itself to a valuational attitude, even though

much of its content involves at least a genetic account of judgments of worth.

The first work in industrial psychology was performed by engineers rather than by professional psychologists—just as the first educational techniques were probably unearthed by parents, priests, or military leaders before pedagogues developed them. In the eighties Frederick W. Taylor, generally known as the father of scientific management, instituted a system of rest pauses with a group of unskilled laborers engaged in heavy muscular work and secured an enormously greater output by a cyclical arrangement of the day's activities. Toward the end of the century Frank Gilbreth, a successful building contractor, improved the methodology of construction, particularly bricklaying, by superior routing of materials and elimination of needless movements. These two movements converged in the first decade of this century in the scientific management program. This was the heyday of the American "efficiency expert" (e.g., Harrington Emerson), and both the real and self-appointed disciples of Taylor and Gilbreth devised novel, not to say freakish, schemes of plant and labor management. Scientific management had no uniform connotation then, but it speedily became a major social and political issue because of its connection with the welfare of the working classes. For a variety of reasons it fell into disrepute from which it did not emerge until the new industrial revolution began in 1921.

Meanwhile, academic psychology clung to its ivory tower. It had sent a goodly number of pioneers into the schoolroom and the clinic; but no psychologist who respected his position had dared venture into the office or workshop. The first man to break the ice was Hugo Münsterberg, an energetic and versatile German whom William James had called to the Harvard laboratory in the nineties. In 1913 appeared his *Psychology and Industrial Efficiency* which constitutes a prolegomenon to all future industrial psychology. This volume was an outgrowth of his services as a consultant to the Boston Elevated Railway Company where he was engaged in reducing accidents, selecting employees, and improving performance. He brought into action those facts of differential psychology which had been accumulated by Cattell and his pupils and indicated the rich possibility of testing procedures in the industrial field.

Sporadic studies in advertising had appeared even before Münsterberg's famous volume, but a definite psychological attack upon marketing problems first appears in the experimental reports of E. K. Strong, Jr., during the years 1911-14. An outstanding event for 1915 was the beginning of the first division of applied psychology in an American university at the Carnegie Institute of Technology. Under the leadership of W. V. Bingham an able group of psychologists commenced operations in the borderline areas of psychology and such activities as life insurance salesmanship, retail marketing, personnel research, and vocational guidance. In the same year Great Britain organized its Health of Munition Workers' Committee to cope with the problem of increasing the efficiency of both management and labor during the war crisis. Its "interim reports" did yeoman service in awakening public and scientific interest in the important industrial problem of fatigue and efficiency.

The year 1917 was a red-letter date for applied psychology. America's entry into the World War met with an offer from the American Psychological Association to place its technical skill and resources at the disposal of the government during the national emergency. The well-known Army Alpha intelligence test, rating scales, and numerous trade, proficiency, and performance tests were the major outcomes of this episode. This year was also marked by the publication of Hollingworth's and Poffenberger's *Applied Psychology*, the first American volume to assemble under one cover the essential facts of this specialty. A new technical journal is always a token of an interested body of readers, and it is in this light that the first issue of the *Journal of Applied Psychology* (1917 *ff.*) must be interpreted. In Germany the Imperial Railways began to use psychological measures in the selection of locomotive engineers, followed by a quick extension to all other phases of the organization.

The Industrial Fatigue Research Board of Great Britain (organized 1918) was a continuation of the valuable Health of Munition Workers' Committee. Supported by government funds, it maintains a distinguished staff of investigators. The reports of the Board now total more than sixty and every report is a model of scientific excellence. Its name has recently been

changed to the Industrial Health Research Board as being more truly descriptive of its functions.

After the war the movement toward organization advanced rapidly. The Scott Company of Philadelphia (1919-1923) was an organization of professional psychologists specializing in personnel problems; its activities served more than any other single factor to familiarize American business men with the enlightened practice of the War Department. Moede established his *Praktische Psychologie* in 1919, the same year in which Giese opened the first *Institut für praktische Psychologie* at Halle.

The following year (1920) witnessed the foundation of the Central Institute for the Science of Labor in Moscow, a creation of the new Soviet régime. Link's *Employment Psychology* (1920) is representative of the success which attended modifications of the old hiring and firing methods. Great Britain determined to profit permanently from its war-time experiences and endowed the National Institute of Industrial Psychology in 1921, with Charles S. Myers, a distinguished Cambridge psychologist, as its director. A journal bearing its name appeared in the following year. The Psychological Corporation (New York) was founded by Cattell in 1921 to serve as an agency for bringing business and industrial leaders into contact with authorized experts. Even Japan fell into line with a new Institute of Industrial Efficiency at Tokyo in 1921, as a branch of Kyocho-Kai (Association for Harmonious Coöperation between Capital and Labor).

The Personnel Research Federation was formed in 1922 through the coöperative efforts of the National Research Council, the Engineering Foundation, and the American Federation of Labor. It is the lineal descendant of the Carnegie group of applied psychologists which disintegrated shortly after the war. Its organ, *The Personnel Journal,* is the major periodical for industrial psychology in this country.

Germany continued to move ahead in this field by the appearance of *Industrielle Psychotechnik* (Moede) in 1923, followed in 1926 by a rival periodical, *Psychotechnische Zeitschrift* (Rupp). A slightly more popular journal, *Industrial Psychology,* was its American counterpart, also begun in 1926 under the editorship of Professor Donald Laird of Colgate University.

Publication was suspended in December, 1928, because of inadequate support from business executives.

CHRONOLOGY

1903 F. W. Taylor's paper on "Shop Management."
1907 *Zeitschrift für angewandte Psychologie,* edited by Stern and Lipmann.
1908 First Bureau of Vocational Guidance, Boston (Frank Parsons, Director).
1909 Gilbreth's "Bricklaying System."
1911 Strong's laboratory studies in advertising.
1913 Münsterberg's *Psychology and Industrial Efficiency.*
1915 Division of Applied Psychology at Carnegie Institute of Technology (W. V. Bingham, Director).
Health of Munition Workers' Committee.
1917 Journal of Applied Psychology founded.
First American professorship of applied psychology (held by Dr. Baird at Clark University).
Hollingworth's and Poffenberger's *Applied Psychology.*
1918 Industrial Fatigue Research Board of Great Britain.
Committee on Classification of Personnel trade tests.
1919 Psychotechnical laboratory at the Technische Hochschule in Charlottenburg (Professor Moede, Director).
The Scott Company.
1920 First International Psychotechnical Congress at Geneva (Professor Claparède, Chairman).
Central Institute for the Science of Labor (Moscow).
1921 National Institute of Industrial Psychology (Charles Myers, Director).
Psychological Corporation founded by J. M. Cattell.
Japanese Institute of Industrial Efficiency.
1922 Personnel Research Federation.
1923 *Industrielle Psychotechnik* (edited by Moede).
1926 *Psychotechnische Zeitschrift* (edited by Rupp).
Industrial Psychology (edited by Laird).

At present, England and Germany seem to be well ahead of America in both support of, and activity in, this branch of psychology. The German Railway system and the great Krupp works maintain psychotechnical laboratories as part of their operating overhead. In England, most representative industries have been studied and invariably benefitted by investigators from the National Institute. The United States seems to suffer temporarily from its lack of centralization; traffic problems, employee selection, and personnel administration constitute our

main strength. We are in danger of not contributing our proportionate share of original research and of losing contact with the new ideas constantly emanating from university laboratories. Our country needs a National Institute of Industrial Psychology, allied perhaps with the Bureau of Standards, to serve as a clearing-house and agency for coördinating and advancing investigations in this sphere of human interest.

C. Basic Psychological Concepts

If applied psychology had to wait for its parent, pure psychology, to attain some degree of maturity before its own genesis, what grasp of this basic knowledge is prerequisite to understanding industrial psychology? We cannot make this a treatise on general psychology. It is assumed that a course of reading or series of lectures involving consistent study of general psychology will precede and be adequate preparation for appreciating the subject matter presented in this series of readings. It is hoped, however, that any intelligent reader with some appreciation of industrial problems and some insight into human nature can derive benefit from the contents of this volume. Nevertheless, we all may profit from surveying briefly our accretions of the basic body of facts and orientate ourselves before approaching specific industrial problems.

The science of psychology is a study of human nature and its activities. In general it has used two methods of investigation, each leading to an emphasis on two different aspects of an individual's activities. One aspect is that of which the individual studied is aware, his own conscious processes, sensations, images, ideas, feelings, impulses, and emotions, which are investigated chiefly through his reports. The other aspect is that of which others can be more or less directly aware, consisting of activities which can be observed or otherwise sensed. These activities are forms of behavior which may affect the welfare of other persons, or otherwise be of common interest. That is one of the reasons why psychology, particularly the various forms of applied psychology, has come to be essentially a study of human behavior.

The behavior of a man, as of all living organisms, consists of the sum total of his processes of adjustment within himself

and with his environment. Many of these processes involve the modification of environment to suit his own nature. All the processes are reactions to stimuli, which arise from lack of adjustment or equilibrium in his own tissues and bodily structure, or in their relation to outside factors. When the muscles, nerves, and other body organs are well rested and nourished, the food assimilated as available energy in these muscles and various organs serves as a stimulus to their activity. Thus man has urges to various forms of motor activity. Having reacted in this way, the waste materials in the body serve as stimuli to their elimination and to rest and sleep. The lack of available food energy in the body stimulates the individual to seek and take in food, which is one basis for the many ramifications of behavior in economic life. Having got the food and rest, the organism is both ready and stimulated to act again. When it is thus ready to act, to do so is satisfying, and not to do so is annoying. Thus activity leads on to further activity. In this sense, the life of an organism is analogous to the cycles of a gas engine. The explosion and sudden expansion of the gases in the cylinder pushes out the piston and gives energy for work activities. Part of this energy becomes kinetic energy in the flywheel and then pushes the piston back to displace the waste gases. It further causes the piston to draw in fresh fuel for the next explosion or release of energy. The similarity with the cycles in the living organism is evident. Food gives the energy which is released in the muscles or other organs. It is released or exploded by the stimuli carried to the appropriate organ by the nerves, which are analogous to the ignition wires on the engine.

The nervous mechanism for controlling the discharge of energy in the human being is so complex that our analogy with the engine is weak at this point. The forms of activity may have infinite variations. In fact, the activities of the neural structures become important in themselves. These neural mechanisms may act more or less vicariously for the implicit behavior of grosser mechanisms. Thus man gets satisfaction not only from muscular activity but also from his neural substitutes for it, which he is aware of as mental activity. He not only enjoys an exciting hunt, he also enjoys reading or dreaming of one. He finds he can manipulate ideas of things

much easier and more economically than the real tangible objects. He can build bridges or houses and remodel or destroy them in his imagination without any qualms. By creative imagination or reasoning he can invent or design a machine of materials which he does not have present in substance. Thus in his mental activities, known on the objective side as neural activity, he has widened his field of manipulation far beyond the tangible objects in his hands.

In all these activities the individual is tending toward adjustment, that is, the relief of tensions or urges within himself, which in turn came out of previous activity or contacts with environment. Subjectively, he is trying to sense his world, interpret it, and make the right reactions to it to satisfy his urges. In this he often calls on previous experience by *remembering* it. He may combine these old experiences in new forms, a process called *imagining* or, more commonly, *imagination.* He may be blocked in the satisfaction of his urges by meeting a new situation in his environment of which he has no ready form of reaction or solution. Then he may mentally manipulate the elements of the situation and his experiences relative to it in a sort of trial and error way until he finds a successful solution. This is known as *reasoning.* He may meet an emergency situation in which he reacts violently, involving a stirred-up state of mind, that is, a complex of mental activities known as an *emotion.*

All these various forms of activities leave their effect on the living modifiable nervous tissue. The more frequently an act is performed, the greater the probability of its recurrence in similar situations at a later date. This is the well-known *Law of Exercise.* Since this change takes place in living tissue, the change is more permanent if the exercise or use of this tissue is distributed with intervals between reactions, thus permitting time for the stimulated growth changes to take place. Furthermore, if an act is accompanied by pleasantness, the tendency to that act is stronger; and if an act is accompanied or immediately followed by unpleasantness, the tendency for that act is weaker. This is often called the *Law of Effect.* Changes in the nerve tissue, at least at the connections or synapses, constitute *learning,* and the laws governing the changes are laws of learning. Much of learning consists of changes in which an

old reaction is made to a new stimulus, or a new reaction to an old stimulus. That is, some element or condition of a total situation present during a response to a stimulus also becomes attached to the particular response and may serve as a substitute for the original stimulus. This is known as *conditioning*. A loud noise produces fear reactions in a child. When a noise was made each time a child reached for a rabbit, the child ultimately came to fear the rabbit.

The things which men learn to do are all outgrowths of acts which can be performed natively. The raw materials out of which mature conduct is fashioned are those innate impulses which drive men toward certain objects and away from others. It is the impossibility of maintaining a permanent equilibrium between the tissue needs of the organism and the pressures of the environment which gives rise to the numerous forms of individual activity. The major requirements of sustenance have been variously catalogued, but the following urges appear to be common to the human species: hunger, thirst, to rest and to sleep, sexual satisfaction, random activity which includes manipulation and curiosity, flight, self-assertiveness. A happy life for anyone appears to depend very largely upon the harmonious expressions of these tendencies. They form the major portion of our biological heritage and account for the principal uniformities in motive and action among all classes of humanity. In the next section of this chapter we see their relation to the work activities.

Individuals differ considerably in their capacity to meet new situations and make adaptations. Aptitudes may appear in general comprehensive activities or in specific lines. The word *intelligence* is reserved for an average cross-section of a man's talents, the relative level of which remains fairly stable throughout life. Intelligence cannot be measured directly, but is measurable by an analysis of its products. The whole technique of mental testing is based upon the statistical concept of a central tendency or norm and proportionate deviations therefrom. For any given age group, superiority in a performance is indicated by positive variation above the average of the population considered; and inferiority is indicated by results below the average. Intelligence is generally positively allied with other desirable traits, e.g., a person of high intelligence

quotient is more likely than chance would allow to possess superior physique, social graciousness, emotional balance, and moral character. The implications of this in educational and industrial administration are tremendous.

Specialized traits appear to be such talents as mechanical ingenuity, musical endowments, mathematical gifts, speed of recitation, or accuracy of motor control. Their independent character is not very well determined as yet, but they suggest the need for measures of other than general capacity, particularly in dealing with problems of vocational fitness.

A synthetic presentation of the total personality is necessary to redress the balance disturbed by an analytic treatment of human behavior. Personality may be viewed as the sum total of an individual's traits which possess social significance. One must avoid the fallacy of personality "types," for, strictly speaking, there is only one type, viz., the average of the human species. Often a given type is thought of in terms of extreme deviations from the mean, e.g., the familiar contrast of introvert and extrovert, with most people probably ambivert in reaction. A similar opposition appears in the case of ascendance-submission. Some persons characteristically adopt a dominant (not necessarily domineering) attitude in the presence of objects or other people, while some normally assume a compliant attitude. But most of us hover between these limits, assuming whatever mental set is indicated by the complete situation. It is generally unwise and also unfair to classify anyone on the basis of two or three prominent attributes. A more scientific description would specify quantitatively a large number of traits and combine them into a characteristically individual "profile." Iron does not differ from lead solely in atomic weight and ductility, but rather in a whole host of physicochemical properties. An even greater variation is found in two human beings who may superficially appear quite alike.

Our efforts at a scientific study of human nature and its activities has led us to look upon man objectively. In fact, we have compared him to a machine. We must remember, however, that this is all merely simplification in order to make understanding easier. We must not fall into the error of oversimplification and fail to be aware of all the facts. The individual himself is most aware of the other aspect of his

behavior. He does not always analyze his sensations, impulses, feelings, ideas, emotions, but he is vividly aware of them. We shall see that some of the most important advances in industrial psychology have resulted from taking account of these more subtle mental processes as factors in human behavior. Individual reports of feelings and attitudes have been invaluable aids in attaining a true understanding of the more baffling problems of morale and efficiency in industry.

D. Why Men Work

Industrial psychology does not naïvely accept the fact that men are to be found pretty generally earning their living by engaging in manufacturing enterprise. How did this impressive and decidedly unnatural process arise? When we raise this question we are not thinking in terms of scientific advances and historical conditions: our inquiry relates to something far more fundamental. What set of urges operates to draw millions of men, women, and children daily to the factories and offices of every nation to discharge what we call the work of the world?

It is almost an axiom in industrial psychology that the causes for man's occupational activity are multiform. There is no one single desire, such as the wish for wealth as such, which actuates all men in their business affairs. Consider the case of a small entrepreneur who invests all his resources in a plant of his own design, hires workers to assist him in the production process, and takes an active part in distributing the finished goods. What forces are driving him during all these stages? It would be a very superficial answer to say that he wanted "more money" and the added purchasing power which money implies, solely because the basic needs of food, shelter, and clothing can be met in no other way. Not infrequently many men, deeming themselves very frank, will acknowledge that that is all they are interested in. But the psychologist realizes that men may be swayed by powerful motives of which they are utterly unaware. So without disparaging the paramount position that money rightly or wrongly occupies in the contemporary economic order, let us see what other possible wants are present in our manufacturer.

The self-assertive tendency is probably found in some form

in all people. Its expression is quite varied, appearing as pride, vanity, argumentativeness, aggressive posture and manner, display, or even the quiet enjoyment of power. Many a political boss shuns actual office-holding but takes immeasurable delight in the rise and fall of his puppets. It is perfectly conceivable that our enterpriser wishes to have the community recognize him as an important individual; or have his name emblazoned on the firm's stationery; or, like the centurion, see men go when he said "Go!" and stop when he said "Stop!"; or even to outdo some rival in the visible and splendid evidence of his prosperity.

The family motives play a big part in the lives of most mature men. Sexual satisfaction in our civilization normally carries with it financial responsibilities. The approval of wife and children acts as a powerful incentive to accomplish those things which will make them happy, even though the man himself may take little direct joy in his achievements *as such*.

Sheer habit also plays a tremendous part in keeping a man at his job, even if it did not lead him there originally. The helplessness of the successful retired business man is proverbial. There was one elderly office hand who received a month's vacation, but drifted back to his desk in a few days "to watch the other fellows work." It may be that the play impulses in such men have atrophied; at any rate, the inadequacy of a mere "cash nexus" account of business activities must be apparent. These influences are merely illustrative of many others which may operate in the lives of industrialists. The point of view here represented is in sharp contrast to that in vogue a century or so ago. Then the man of business was supposed to be incarnated in the "economic man"—a strange creature who bought in the cheapest market and sold in the dearest, whose constant aim was to attain a maximum of pleasure and a minimum of pain. Human beings were supposed to be swayed by the "hedonic calculus" i.e., an invariable tendency to weigh the gains offered by one course of action against the losses entailed, and to act accordingly. This obviously attributes a greater rationality to men than they actually possess, for our newer knowledge of man's original nature shows his actions to be initiated and maintained by a variety of internal "pushes." These impelling forces often control man, not in the direction

of his maximum ultimate good, but frequently to his own distress.

E. Plan of the Book

The reader is asked to stop at this point and examine the table of contents given at the beginning of this volume. An inspection of the sequence of chapter titles is perhaps the easiest way of identifying the subjects which come within the purview of industrial psychology.

A simple figure may aid in understanding the organization of the material presented in the following pages. Assume that you are absolute master of a large modern plant which is ready to begin manufacturing some common necessity. You are a competent technical and financial expert and convinced of the desirability of the psychological viewpoint in all management affairs. A scientific study of the individual workman is the focus of your energies. Your first task would be to find the right men to staff your plant; hence, sound employment practice is the theme of the early chapters. You would reject all pseudo scientific systems of characterology and trust instead to devices which have both theoretical and empirical sanction. Having chosen your workmen by the best means available, you would normally find it wise to train them for their special tasks in the best possible way; a corresponding section on industrial education therefore appears in the book at this point.

As soon as the worker is hired and "broken in," new problems appear. You may rearrange the hours and conditions of work in the interests of greater output and *esprit de corps*. Accidents harm employer as well as victim, so that a study of the human factors predisposing to injury is of inestimable value to everyone. You will find critics assailing the monotony of industrial operations and will look for aid in removing it. Fluctuations in morale will occur, and the dollars-and-cents difference which this makes will be most impressive. The intricacies of human relations in the commercial world lead inevitably to a search for the qualities of leadership best suited to cope with them.

Even when you have solved the psychological issues raised by the plant personnel, there remain the broad contacts with the consuming public. The entire marketing process hinges upon

meeting some human need—if these needs change, the product itself must be modified.

In brief, then, this volume follows the order in which these typical industrial problems arise. The chief value of such a sequence is its naturalness. As you trace the development of the subject with this clue, try to distinguish the following contributions of psychology to industrial efficiency:

1. Contribution of content, e.g., facts about the instincts or urges, habits, etc.
2. Contribution of technique, e.g., the various testing instruments
3. Contribution of attitude, e.g., the emphasis on the individual

QUESTIONS

1. (*a*) Who were pioneers in industrial psychology before the psychologists?

   (*b*) What events made 1917 a red-letter year in industrial psychology?

   (*c*) Name three journals in applied psychology.
2. Explain how some facts of general psychology have been applied in industry.
3. What unscientific methods or otherwise questionable practices have been applied to problems of human behavior in industry?
4. Are the principles and applications of psychology more or less likely to be consistent with the principles of ethics? Why?

CHAPTER II

BASIC PRINCIPLES

The material presented in this chapter is designed to orient the reader in the fundamentals of industrial psychology. Ties of common origin and objectives unite it with the wider field of applied psychology, which in turn rests upon the broad base provided by general psychology. To place the study in its proper setting requires an analysis of its relationships and an appreciation of the reasonableness of its being. It cannot be too often emphasized that at the opening of this century industrial psychology was nonexistent. That fact alone goes far in explaining its contemporary characteristics.

A. The Field of Applied Psychology

The following arrangement (modified from Poffenberger) may help the reader locate the field of industrial psychology among the numerous branches of applied psychology:

MAJOR DIVISIONS (well established)	Educational psychology Medical psychology Legal psychology Business psychology Vocational psychology Industrial psychology
SPECIALIZED DIVISIONS (not so well developed)	Psychology of aesthetics Psychology of religion Psychology of music Psychology of play Psychology of athletics Psychology of the handicapped Military psychology
PRACTICAL INDIVIDUAL PROBLEMS	Suggestion Morale Vehicular accidents Mental effects of drugs Etc.

1. *The Function of Applied Psychology*

W. V. BINGHAM, "On the Possibility of an Applied Psychology," *Psychological Review*, 30: 289-291, 294-296, 298 (1923)

Today we are witnessing the growth of a lusty child: psychotechnology, offspring from the union of psychology and practical affairs. This child will soon reach a healthy maturity, ready to go its own way. There is noticeable even now a tendency to functionalize the profession, to differentiate responsibility for making psychology useful from responsibility for advancing, through teaching and research, the pure science itself. Such functionalization has long been employed in other sciences. As engineering is to physics, as scientific agriculture is to biology, as medicine is to physiology, as pharmacology is to physiological chemistry, as forestry is to botany, as statistics is to mathematics, as navigation is to astronomy, so ought psychotechnology to be related to psychology.

Already a few trained men are earning a livelihood as practicing psychologists. To be sure, most of the work of commercial application is still done as an avocation, by psychologists who are first of all scientists rather than technicians and often of necessity but slightly familiar with the setting of the practical problems to be solved. Even so, the achievements in applied psychology have been measurable. Many are the distinguished scientists who have helped its development. In the roster of past presidents of the American Psychological Association are few who have not engaged in the practice of some phase of applied psychology and made additions to the substance of its subject-matter. Being a psychologist has meant being both scientist and human engineer.

Up to the present time, differentiation or functionalization has not proceeded far. It has been assumed that any real psychologist could apply his science—insofar as it had possibilities of practical utility—and that anyone who was competent in psychotechnology must be a psychologist. But today this identification is being questioned, just as twenty-five years ago the question was raised whether every psychologist must be a philosopher. There has been set up in the American Psychological Association a section for practicing psychologists, with standards of eligibility which not all psychologists can meet. Tomorrow the young discipline of applied psychology, with its own journals, its own specialists, its own body of scientifically verified content, and its own technique, may be amply able independently to pursue its own proper objectives—the useful prediction and control of human

And yet, some highly able psychologists like to say—at least in private conversation—that there really is no such thing as

applied psychology; and the outstanding accomplishments of psychologists in education, industry, and war have not served completely to silence those remarks. For, what is taught in our universities under the title of applied psychology, they say, is not really a technology in any strict sense of that term. Instead, it consists only of excerpts from pure psychology, padded with illustrations, speculations, and hopes as to how these fragments of principle or method might be pertinent to practical problems. They challenge applied psychology to show any worthwhile subject-matter which is not clearly the property of general psychology or else merely a precipitation of common sense accumulated by workers in the different special fields of application, such as law, medicine, education, and business. There exists today, we are told, no independent discipline of applied psychology, no psychotechnology worthy the name. We are invited to ask whether there is the possibility of an applied psychology, a technological discipline whose regulative concepts can be stated in a way which differentiates it usefully from general psychology. If so, of what sort is its content? And what are its differentiæ and its proper aims? . . .

Applied psychology in the broadest sense is *psychology in the service of ends other than its own.* This definition would furnish an excellent starting point if there were no uncertainty as to the proper aims of psychology itself. Unfortunately a survey of recent literature leaves the inquirer in doubt as to whether our aim as psychologists is primarily scientific, or practical, or both.

Doubtless some of these ambiguities of aim are due to the rapidity with which practical psychology has recently expanded. As a matter of fact, a youthful psychotechnology has already been infiltrated into the science of psychology without our full awareness of what has been happening. Everyone has indeed seen the revolution in psychological activity wrought by the demands of war, of industry, of education, of medicine, and of social work. Everyone has noted the multiplication of researches on practical problems, the increase in the number of psychologists engaged in testing and in personnel administration, the encroachment of courses in applied psychology on student time formerly held inviolate for experimental and systematic training. But not everyone has noticed the resulting vagueness and confusion in the minds of many psychologists as to what psychology really is.

Demands of undergraduate classrooms have tended to heighten the confusion. Elementary students are fond of hearing about the psychology of advertising and selling, eugenics, labor mediation, the typography of the telephone book, or stereoscopic vision

in the movies; and many instructors have tended more and more to fill their introductory lectures with such fascinating topics of psychotechnology. Some teachers have gone the length of introducing students to psychology through the technological gateway, beginning their courses with laboratory exercises in measuring the strength of appeal of advertisements, or the relative effectiveness of methods of learning. No one should deplore such an inductive and concrete approach, provided the instructor keeps always before his own thought the distinction between pure and applied psychology, and insists eventually on a clear recognition by his pupils of this disparateness of aim and content. Unfortunately, this is not always done. Some psychologists seem to have forgotten for the moment that psychology is a science apart from its applications; or they have been led by the practical demand mistakenly to regard psychology as at once a science and a technology.

There is, to be sure, a large company of traditional psychologists who continue faithfully to construe psychology as a natural science and who define its aims to be the *description and explanation* of the phenomena it studies. When the facts of human nature are adequately observed, analyzed, classified, described and explained, these psychologists construe their task as finished. Such a goal does not require an extension of responsibilities into the realm of practical application. Meanwhile, other psychologists keep before them practical aims of controlling human conduct as their ultimate. They feel that their task is not finished until they have forged the metal of their science into working tools.

No clearer statement of this position could be desired than that of McDougall on the first page of his recent "Prolegomena to Psychology" (*Psychol. Review*, 1922, 29, 1-44); "The aim of psychology is to render our knowledge of human nature more exact and more systematic in order that we may control ourselves more wisely and influence our fellowmen more effectively." Psychology, according to such a view, arrives at its goal only when it has contributed to the effectiveness of control over ourselves or our fellows, either directly or through contributions made to the social sciences. Pure psychology is, then, for McDougall, not an end but a means.

Watson is another writer who aims at a technology as well as a science. It should be noted, however, that a Watsonian behaviorism as such has no monopoly on practical psychology. For example, Dunlap's latest text-book says: "The psychology of today is a science of the conscious responses of the organism, and as such is called upon to furnish materials applicable to the problems of physical science, education, industry, and the arts; and to social problems." (*Elements of Scientific Psychology*, 1922, p. 7.)

Contributions to the technique of prediction and control of conduct have been made by introspectionists, as well as behaviorists; while some behaviorists seem content to study behavior as a descriptive science, indifferent to the practical values to which their findings may or may not lead. That practical psychology and behavioristic psychology have tended to be identified is, then, more or less of an accident. If it should be decided that psychology studies behavior only, or experience only, or both, the question still arises whether this subject-matter is studied for scientific purposes of description and explanation, or for practical purposes of prediction and control. No matter whether introspection, or objective measurement, or both methods, are finally decreed to be valid and authentic, the query must nevertheless be met, whether these methods are employed in the service of psychology the science, or in the service of more remote and practical ends. Progress in the science itself and in its applications will, I believe, be fostered if all schools of doctrine recognize that there are these two sharply divergent objectives, the scientific and the technological. . .

The proper aim of psychology as a science is similar to that of all natural science, namely, the understanding of the phenomena it studies irrespective of whether this knowledge does or does not bear on any practical problem of control. Over against this goal, the realization of which brings knowledge, stands the technological objective. A technology aims not at the understanding but at the control of the phenomena it studies. Or, when it seems to aim at understanding, it is for the ultimate purpose of control. As description and explanation is the goal of science, the goal of technology is prediction and control.

If this contrast is overlooked and psychology defined as really not being psychology until it has been made to yield a technique of control, then of course there can be no independent discipline called applied psychology, because no line of demarcation remains. But with a clean-cut statement of the aim of scientific psychology which rests content with intellectual explanations of experience or behavior, we can profitably draw the line between psychology the science, and applied psychology, which is a technology.

2. *Means versus Ends*

Hugo Münsterberg, *Psychology and Industrial Efficiency*, 17-20 (Houghton Mifflin, 1913)

Applied psychology is evidently to be classed with the technical sciences. It may be considered as psychotechnics, since we must recognize any science as technical if it teaches us to apply

theoretical knowledge for the furtherance of human purposes. Like all technical sciences, applied psychology tells us what we ought to do if we want to reach certain ends; but we ought to realize at the threshold where the limits of such a technical science lie, as they are easily overlooked, with resulting confusion. We must understand that every technical science says only: you must make use of this means, if you wish to reach this or that particular end. But no technical science can decide within its limits whether the end itself is really a desirable one. The technical specialist knows how he ought to build a bridge or how he ought to pierce a tunnel, presupposing that the bridge or the tunnel is desired. But whether they are desirable or not is a question which does not concern the technical scientist, but which must be considered from economic or political or other points of view. Everywhere the engineer must know how to reach an end, and must leave it to others to settle whether the end is in itself desirable. Often the end may be a matter of course for every reasonable being. The extreme case is presented by the applied science of medicine, where the physician subordinates all his technique to the end of curing the patient. Yet if we are consistent we must acknowledge that all his medical knowledge can prescribe to him only that he proceed in a certain way if the long life of the patient is acknowledged as a desirable end. The application of anatomy, physiology, and pathology may just as well be used for the opposite end of killing a man. Whether it is wise to work toward long life, or whether it is better to kill people, is again a problem which lies outside the sphere of the applied sciences. Ethics or social philosophy or religion have to solve these preliminary questions. The physician as such has only to deal with the means which lead toward that goal. . . . We ought to keep in mind that the same holds true for the application of psychology in economic life. Economic psychotechnics may serve certain ends of commerce and industry, but whether these ends are the best ones is not a care with which the psychologist has to be burdened. For instance, the end may be the selection of the most efficient laborers for particular industries. The psychologist may develop methods in his laboratory by which this purpose can be fulfilled. But if some mills prefer another goal,—for instance, to have not the most efficient but the cheapest possible laborers,—entirely dfferent means for the selection are necessary. The psychologist is, therefore, not entangled in the economic discussions of the day; it is not his concern to decide whether the policy of the trusts or the policy of the trade-unions or any other policy for the selection of laborers is the ideal one. He is confined to the statement: if you wish this end, then

you must proceed in this way; but it is left to you to express your preference among the ends. Applied psychology can, therefore, speak the language of an exact science in its own field, independent of economic opinions and debatable partisan interests. This is a necessary limitation, but in this limitation lies the strength of the new science.

3. *Practical Interest in Controlling Behavior*

J. F. DASHIELL, *Fundamentals of Objective Psychology*, 6-7 (Houghton Mifflin, 1928)

The interest in understanding human nature—universal in one form or another—is ordinarily not a desire simply to understand. Ultimately it is a desire to get *control*. It may be fairly conceded that any field of purely theoretical concern, such as any of the "pure" natural sciences, is originally motivated and in the last analysis is socially supported and maintained by a practical interest in governing. The "pure knowledge" desire to learn what are the causal or invariable sequences in any body of natural phenomena really springs from the human being's practical demand for regulation and control of things by his own hand. The determination of cause-and-effect relationships by accurate and impersonal investigations furnishes the materials for safe and certain predictions, and these predictions in turn give man his chance to remold his world to suit himself. So it is with the interest in psychology: it springs originally from a desire to control human nature. The human nature to be thus controlled may be another person or group of persons, or it may be one's self.

Such practical desires for the governing of human behavior may be recognized by the popular phrase, "good psychologist," given to anyone who demonstrates special ability to deal with and handle people about him. The labor boss who knows human nature is the one who is able to manage the men working with him in such an effective way as to get the best results for all concerned. A foreman known to the writer once hit upon the device of providing for his gang of laborers in the middle of the hot forenoon and afternoon a bucket of cold beer. The expense of the refreshment was more than offset by the increased output of work—an increase traceable to more than one psychological principle. The boss was merely putting into operation a given set of causes in order to produce a wanted set of effects.

The advertiser nowadays recognizes the importance of understanding certain facts about the buying public: how to set certain effects into operation by providing the causes leading to them. For

example, he might ask himself: Given this definite amount of money to be expended in advertising my product, will it be more effective to use full-page advertisements for as many issues as the fund will cover, or more effective to use only quarter-page advertisements for four times as many appearances? Such a question can be answered only by deciding which set of causes will most certainly produce the desired effect on human beings.

The salesman's very business life depends upon his having some form of influence over other persons. Goods are not relied upon wholly to sell themselves; and the effective salesman understands in some dim or distinct way that one prospective customer should be approached in this way, another in that. He knows that "the black hearse" may be an effective allusion to employ in arguing life insurance before one man, but that it should be most assuredly avoided in the case of another.

Of all men interested in the objective control of human nature, surely the physician is to be mentioned among the first. The somewhat magical idea that he is merely a giver of medicines has long been outgrown. The subject-matter with which he works is only to a limited extent describable as a physiological chemical compound to be changed and altered by doses. For the most part his cases call for an appropriate sick-room atmosphere, in which the physician's confident and reassuring manner is important; many of them yield to treatment only when the pills are highly colored; and a few demand a retraining in emotional habits rather than physical manipulations or chemical drugs.

The lawyer, dealing as he constantly does with different human beings in the persons of his clients, his judges, his jurymen, has to be constantly observant of their traits; for in his behavior before the judge, in his addresses to the jury, in his examining and cross-examining of witnesses, his success is measured by the degree to which he influences them.

The profession of teaching, of course, is founded definitely upon the purpose of controlling persons. The teacher's primary interest is in the learning going on among his students, and a well-organized knowledge of what the helpful and hindering factors are in this learning process forms a basic subject for his study.

4. *A Protest Against Unwarranted Applications*

MADISON BENTLEY, *The Field of Psychology: A Survey of Experience, Individual, Social, and Genetic*, 11-12 (Appleton, 1925)

A difficulty which especially afflicts our own generation is the easy, unconsidered and unscientific way in which it is the fashion

to use the terms "psychology" and "psychological." Almost everything which makes reference to the more intimate aspects of the life of man is now labeled "psychological." We hear of "psychological novels," "psychological plays," "psychological sermons"; of "psychological healing" and "psychological methods in business." Golf has its "psychology" and so have chess and bridge, dress and education. The "psychology of" is one of those interesting phrases which mysteriously appear without warning, run glibly off the tongue, fill the popular magazines, and temporarily excite the public imagination. When such a phrase attaches itself to strong emotional interests, as to religion, health, sex, sport, recreation, and the fine arts, and when further it acquires, as "psychology" has acquired, the profound sanctions of science, medicine, and literature, its influence is likely to be deep and to pass beyond its own intrinsic merits. It is quite true that the advances of psychology have thrown light upon many matters hitherto obscure; but very often the phrase, "the psychology of so-and-so," indicates only a popular and worthless description couched in high-sounding, but ill-chosen, terms. Against these extravagances the novice must be on his guard until he is able to distinguish the genuine from the spurious. Once he is persuaded that whatsoever touches "human nature" is *psychological,* he is hopelessly lost and confused. There will then be for him no place to begin and no place to end. It would be as if zoology were extended to cover everything which concerns animal life. That would include the raising of cattle and sheep, the processes of the slaughterhouse, the care of pets and of domestic animals, hunting and fishing, and so on indefinitely. No; it is only quite special ways of regarding life, only quite definite means for the observation of living things, which fall to the student of zoology. And psychology is just as clearly and closely limited by special ways and special means. To be sure, there are psychological avenues of approach to "human nature" and psychologists are constantly referring to "mind" and to "mental facts"; but these points of regard and these facts always bear the stamp of a particular kind of intellectual interest and the impress of a particular science, which bring them within the borders of psychology.

B. Psychological Problems in Industry

5. *A New Emphasis in Industrial Relations*

JAMES DREVER, "The Human Factor in Industrial Relations," *Industrial Psychology*, edited by C. S. Myers, 16-17 (Thornton Butterworth, Ltd., London, 1929); reprinted in U. S. by permission of Henry Holt & Co.

The discussion of the problems of industrial relations has passed through some curious phases in the last fifty years. In the first instance departure was taken from the current and orthodox political economy, which assumed a society of "standard economic individuals," differing in productive capacity and the like, but quite uniform as regards driving motives. This phase of the discussion might be called the *mechanical* phase, since, from this once orthodox point of view, an industrial undertaking might be regarded in its working as analogous to a complex machine, built up of more or less standard parts, all functioning in accordance with mechanical or quasi-mechanical laws. This phase was followed by a phase which we may call the *organic* phase. The standpoint in this case was more that of Herbert Spencer's social philosophy than that of the orthodox political economy. Spencer maintained that society ought to be regarded as a complex organism, or at least as analogous to an organism. When this point of view is carried over to the case of a large industrial undertaking, we have an undoubted advance from the older point of view, since we are now taking into account the fact that the complexity of relations involved is analogous to that of vital functions rather than of mechanical processes. This is obviously nearer the truth.

At the present time the discussion has entered on a third phase, which may be appropriately designated the *psychological* phase. It has come to be recognized that the complexity involved in industrial relations is not merely a complexity analogous to that of mechanical process in a complex mechanism, or to that of vital function in an organism. Neither of these analogies is adequate, or carries us far enough, though the second is a much closer analogy than the first. The related elements are human personalities. These present a complexity which may in certain aspects be both mechanical and organic, but is also—if we may use the word for lack of a better—spiritual. Industrial relations depend essentially on the interests, impulses, sentiments and passions of human beings. The realization of this fact is perhaps the brightest and most promising feature of the present industrial situation.

6. *The Content of Industrial Psychology*

W. V. Bingham, "Industrial Psychology," *Proceedings of the 1928 Cambridge Congress of the International Industrial Relations Association* (The Hague, Holland)

Those problems of industry may be considered psychological which involve questions of human nature.

Foremost are the problems which have to do with the *worker in relation to his work*. Many such problems arise in helping the worker find the simplest, easiest, most natural ways of doing his work; conserving his energy; reducing fatigue; increasing quality and quantity of output; eliminating personal injuries and lost time due to accidents; removing unnecessary fears and irritations connected with the work; reducing unrest, discontent and dissatisfaction with the job and with the working conditions surrounding it; and increasing the laborer's store of contentment, pride and satisfaction in his accomplishment. These are all basic practical problems of industrial management, most of them capable of at least partial solution through the application of shrewdness and common sense, but all of them offering a challenge to the psychologist to apply his science, and to supplement common sense by analysis, objective measurement and experimentation, very much as he has done in the public schools, in greatly shortening the time required by a boy to complete the job of learning how to read and to compute. Common observation of the behavior of workers engaged in heavy labor or in work requiring close attention, might well have suggested to any sensible supervisor the economy of insisting upon appropriate, properly spaced rest periods; but the fact is that this device has rarely been employed except where science and controlled experiment have first demonstrated its worth and indicated the optimal distribution of rests for the particular tasks in hand. Scarcely more than a good beginning has been made in the scientific understanding of rest periods in relation to fatigue, monotony, workers' reveries, outbursts of temper and radicalism. Here, as in a thousand other aspects of the job in its relation to the individuality of the worker, the psychologist has significant opportunities for industrial application of his science.

A second group of psychological problems arises out of the *relations between a worker and his fellow-workers*. How to harness the impulse to competition, and insure a healthy rivalry for high quality of output or freedom from accidents; how to eliminate the conflicts, irritations and jealousies which sometimes clog the human machinery of the factory; how to prevent loss of working time in idle banter while supplying on appropriate occasions ample oppor-

tunities for good fellowship—these are questions which are ordinarily left to chance or to common sense. More basic is the best means of developing a substantial group solidarity, a ready helpfulness, a willingness of the experienced workers to take the new employees in hand and teach them the practices and ideals of the shop. Then, too, workers sometimes tend to teach each other various fears and notions leading to conscious restriction of output. They may spread an apprehension of lay-off or of piece-rate cutting, when no genuine basis for it exists in reality. Here the problem arises as to how such unwholesome influences of workers on one another can be minimized, or replaced by influences which make for better mutual education and coöperation. These are complicated problems of practical social psychology.

Yet a third group of problems centers in the *relations of the worker and his immediate supervisor.* These relations may be harmonized by making sure of the reasonableness of the work requirements; by making work assignments and instructions clear and definite; by introducing an equitable routine procedure of distributing work and assignments and instructions clear and definite; by introducing an equitable routine procedure of distributing work and materials, to do away with the possibility of partiality or favoritism in these regards; and by making the supervisor a skillful instructor and an understanding helper of his men, as well as a fair and just disciplinarian. The psychological aspects of these processes are sufficiently obvious.

No less psychological in essence are many of the problems arising out of the *worker's relations to the management.* Consider, for example, the assurance of steady employment. This has often been made possible through improved market analyses, business forecasting and careful scheduling of production. The effect produced on the worker by relief from the overshadowing fear of lay-off is a psychological fact of major importance. So, too, with many questions of wage rates, methods of payment, and policies regarding stock-ownership, insurance, pensions, housing, loans, vacations, facilities for education and recreation, and the like. The adequacy of the machinery provided for the airing and prompt adjustment of grievances reflects the management's grasp of practical industrial psychology. The same may be said of its success in providing suitable recognition of merit and competence, not so much through resort to non-financial rewards and recognition (although these have their value and are often prized), but rather through proper payment by results, and adequate provision for advancement. Many economists are prompt to insist today that the problem of wages has its psychological aspects.

Group relations of workers and management have presented continuing problems whose psychological aspects are sometimes almost as perplexing as their more obvious economic phases. The reader need only remind himself of the misunderstandings, the mutual suspicions, the conflicting preconceptions and unyielding prejudices which too often have beclouded the thinking of workers' representatives and employers alike, when collective vs. individual bargaining, trade-unions vs. shop committee organization and similar issues of joint relations have been brought forward.

Both parties have at times resorted to espionage in their fact-finding, a practice as unsound in its psychology as in its ethics. Both have been prone to color their inquiries with preconceived conclusions. Better methods of ascertaining the truth about actual and imaginary grievances, and the purposes and practices of employer and employee alike, will tend to bring about more wholesome industrial relations. The duty of undertaking to improve these techniques of fact-finding is one which the psychologist must not hesitate to accept.

7. *Various Contributors to Industrial Psychology*

J. McK. Cattell, "Psychology in America," *Scientific Monthly*, 30:126 (1930)

Psychologists have been academic teachers and have naturally taken up problems concerned with children and schools. Other aspects of objective psychology to which these lead have been measurements of animal behavior. We are apparently somewhat behind Germany in the applications of psychology to industry, but we have a large development of industrial management and personnel work—the Taylor system is American—which will ultimately be taken over by official psychology. Even our swarms of cranks in the air above and our shoals of charlatans in the water beneath may be found to have contributed their bit, when natural selection and survival of the fit are given ample time.

8. *Alliance of Psychology and Management Engineering*

W. V. Bingham, "What Industrial Psychology Asks of Management," *Bulletin of the Taylor Society*, Vol. 9, No. 6 (1925)

Psychologists and management engineers are drawing together. They are becoming more aware of each other's problems and points of view. Increased coöperation has been proposed. If this is to be accomplished, psychologists have four things to ask of management—patience, discrimination, research opportunities and reliable

criteria. Of these, the fourth is basic and implies more than may at first appear. . . . Let us consider each of these points in turn.

1. Psychology asks management to be patient because we know that many of the most pressing problems of industrial psychology are problems in social psychology—the most backward, most speculative, least scientific branch of psychology. Forward strides have been taken by social psychology in recent years as a result of contacts with medical and clinical points of view; but not everyone recognizes how far we still are from an ideal technique of research in problems involving volitional or emotional aspects of human nature and the clash of personalities. Psychologists need time and help in learning how to measure and to mold fundamental drives and basic traits of personality and character.

We ask you to be patient because all thoroughgoing research moves slowly. The Mazda lamp of today was not developed within a month or a decade after the appearance of Edison's first incandescent light. Similarly, it has taken nearly twenty years for psychologists to bring the methods of measuring intelligence to their present modest degree of reliability and validity. It is hardly to be expected that during this year or next, psychologists, even with the heartiest coöperation of management, will be able to solve definitively any large number of questions which are puzzling us all today.

We ask you to be patient because as yet too few psychologists have an adequate background of familiarity with industrial management. An opportunity to see some of your problems from the inside will be most helpful to psychologists in developing good judgment and insight. Some of us know only too well our limitations of familiarity with actual working conditions of plant and office management. We ask you to be patient while we are getting this necessary background.

We must ask you to be patient also with psychologists whose interest in the problems of management differs in some regards from that of the management engineer. Our methods of investigation, to be sure, are not fundamentally different from those of any science which employs analysis and measurement to establish significant correlations between phenomena. But a difference between psychologist and management engineer sometimes comes to light in the relative emphasis placed on importance of output or profits on the one hand, as against comfort and satisfactions of the workers on the other. Management engineer and psychologist are both concerned to increase output and also to increase the well-being and enduring satisfactions of the men; but the psychologist is likely to think first of how he can help adjust the worker to his work, or

how he can make the work more tolerable or agreeable, trusting that there will be no diminution of profits but perhaps an increase.

Another difference in point of view sometimes shows itself when psychologist and management engineer are faced by an acute practical problem. The engineer wants to clear up the bad situation at once, introducing simultaneously as many remedies as his good judgment suggests. The psychologist, on the other hand, wants to test out certain general principles because he is looking to the remote future as well as to the immediate problem; consequently he is more likely to want to introduce the proposed improvements one at a time, letting each operate singly long enough to measure the results and demonstrate whether or not it is really an effective remedy. In other words, he wants to control all the variables and modify them one at a time, in order to be certain of his scientific findings. The psychologist is tenacious of his scientific method, and for this reason asks management to be patient.

2. Psychology asks more discrimination than management engineers have sometimes shown in the selection of psychological collaborators. I have known more than once a young man or woman whose psychological training was limited to a few months' experience as routine assistant in the Army Psychological Corps or in a social service clinic, or even to a few undergraduate courses in college, to succeed in selling service as psychologist to a business executive. The standing of psychology has sometimes suffered because industrialists have judged results from their observation of the work of such amateurs. If you want a consultant in chemical engineering, would you invest in a young man whose training is limited to undergraduate college laboratory courses, supplemented perhaps by a few months as Sergeant in the chemical warfare service? These neophytes are often extremely useful as assistants, but are rarely competent to take primary responsibility in industrial applications of their science. The American Psychological Association maintains a rigid standard of membership and is open only to those who have earned the Doctor's degree in psychology and have published acceptable research. Membership in the Association is a virtual certificate of fundamental training in the science.

But membership in the American Psychological Association does not guarantee familiarity with or experience in industrial psychology. The Psychological Corporation, with offices in the Grand Central Terminal, will at any time endeavor to answer inquiries as to the experience of American psychologists in particular fields of specialization. With these sources of information, there is little reason why management engineers should not have a basis for

discrimination in the selection of the psychologists with whom they may wish to coöperate.

We ask discrimination also in the acceptance and use of research findings. Sometimes a psychological problem has been solved under laboratory conditions or with a limited number of subjects, so that conclusions of a tentative nature have been warranted; but when these findings have been applied without reservation or further trial under factory or office conditions, the results have been unsatisfactory both to psychology and to management. Generalizations resting on slender foundations should be scrutinized closely and applied with discrimination. I have been warning employment managers for years against hasty use of the results of psychological tests. They should first make careful experiments within their own organizations, with the coöperation of a psychologist who knows statistical method in this field. Only after these try-outs have resulted in a fresh validation of the tests and a determination of the relative weight to be assigned to test scores in comparison with the other available data, should the employing office make any actual use of test results.

In one other regard discrimination is invited. Industrial psychology ought not to be identified exclusively with any single phase or movement such as intelligence tests, or psychoanalysis, or vocational guidance, or mental fatigue studies, or the psychology of practice and skill. Some of these fields of psychological investigation are much less highly developed than others. If you decide that they are vague in practice, or unsound, you will find plenty of competent psychologists to agree with you; but it is hardly discriminating to infer that all psychology is impractical.

3. Psychology asks management for research opportunities. . . . We need opportunity for research on real problems, on adults rather than children and youths, with suitable facilities and assistance, under factory conditions. To be sure, research of this character is more difficult than laboratory investigation. Conditions are more complex. Variables are harder to control. Nevertheless, the time has come when psychology will advance more rapidly if an increasing number of its investigators are occupied on such problems.

4. Psychology asks management to supply one of the indispensable tools of industrial research, namely, reliable criteria. This point has been already urged. Let me illustrate it again from the much discussed field of tests for vocational selection. An enormous amount of ingenuity and toil has been wasted in devising various psychological tests and other predictive measures of aptitude or accomplishment, and in trying out these measures at considerable expense of time and money on large numbers of employees—opera-

tives, clerks, or sales people—only to discover after all the tabulations of results have been made, that the criteria against which the validity of the tests had to be checked were unreliable.

9. *Organized Labor and Applied Science*

Samuel Gompers, "Coöperation of Workers in Study of Industrial Personnel Matters," *Journal of Personnel Research*, 1: 53-55 (1922); reprinted by permission of Williams & Wilkins Co.

Today no one disputes the fundamental service which research makes to progress and to maintaining the fabric of civilized life. Our war struggle which forced us to reorganize many activities in order to reach a surer basis for what threatened to be a death contest, broadened our concept of the relative importance of research. It is particularly fitting then that representatives of every interest in life should have just the sort of conference for which we have met, in order to consider the fullest service research can contribute to the problems of each distinctive field. Whatever help research and science can offer labor will welcome.

The service of scientific information is not a new idea to labor. Our efforts may sometimes have been a bit hazy in concept and perhaps our methods and terminology lacked the discriminating sureness of the trained scientist—but we knew what we needed. You may perhaps not know that our federal and state bureaus of labor statistics are the results of persistent educational propaganda of organized labor. It was our desire that these bureaus would render practical help in dealing with labor problems. The campaign which the International Cigarmakers Union waged to abolish the tenement system of cigar making started forces that helped to develop the field of industrial hygiene. We knew that the tenement system was demoralizing our craft and killing cigarmakers and their families. We applied in vain to the board of health, the state legislature and the courts—only when we built up a strong economic movement could we make health knowledge effective.

A persistent effort has been made to saddle upon labor the odium of opposition to improved methods and machinery in production. This is not true as a general statement. What labor has opposed is an effort to exploit them by the use of improvements that are intended as a blessing to mankind. Labor is rightly suspicious of changes which are introduced without explanation and whose effect upon their welfare is not considered. Labor's coöperation has been assured in the introduction of even such a revolutionizing machine as the linotype when the workers had a voice in determining the use of the machines instead of going under machine control. My

office was in Indianapolis opposite that of the president of the International Typographical Union at the time this policy was in the making and I earnestly urged upon Mr. Prescott the course that was followed.

Labor is not opposed to increased production or improved methods. Quite the contrary. We recognize there can be no permanent betterment of standards of living for all except by increasing the things that contribute to better and more satisfactory living. But we hold as a fundamental that material products are not the ultimate of production, but service in better life for humanity. The essence of this fundamental as applied to labor problems we have formulated in the declaration we call the charter of economic freedom: "The labor of a human being is not a commodity or article of commerce."

Now one more point upon which frank statement is necessary. One of the early attempts to apply science to labor questions came with types of scientific management that treated wage-earners as machines or simply laboratory material. Organized labor resisted —that resistance helped to humanize concepts and methods in management, until now the human nature of the workers is recognized as the fundamental factor in determining policies.

This preliminary statement clears the way for consideration for the problem of the conference—just what sort of a working relationship ought organizations of labor and science to enter into and what type of problems can we be mutually helpful in working out together. I take it that all of us have too much vision and experience to think we can "solve the labor problem." That is a life problem that will last as long as life. Fortunate will we be if we can make a contribution that will simplify the efforts of those who are dealing with specific phases.

This conference is concerned with the field of industrial government which we can for convenience divide under two heads, the law-making function and the administration. Experience has taught organized labor that we can only maintain opportunity for freedom and well-being when laws for industry are made by those directly concerned, the management and the workers. Clearly the formulation of laws to govern industry is not to be the function of any organization suggested by this conference. Science and research may furnish the law-makers with data and suggestions to assist the law-makers in reaching the best considered judgments—but confusion and retrogression will follow any attempt to usurp prerogatives.

On the administration side of personnel relations, science can make rich contributions if conceived and directed in the spirit of

service to mankind. Such efforts would win good-will and confidence by results. Labor is not coming here to question the value of fundamentals that have proved themselves in many tests, but to consider additional methods whereby we can advance both the material and spiritual life of all.

My suggestion is that we ought not to formulate a comprehensive scheme of work to be worked toward in the months to come, but that we should do best to decide upon one forward step at a time, thus utilizing our accumulated experience to help us to better judgments. I think that by gathering data on non-controversial subjects, we shall probably be able to bring out facts underlying other problems that have hitherto seemed controversial, in such a way as to indicate conclusions. This method may gradually narrow the debated field.

The problems occur to me now which could be undertaken with advantage:

1. To collect data on hours of work in continuous industries, indicating what plants have the two-shift system and which the three-shift; data showing comparative production under the two systems. Work out plans showing how a third-shift system could be installed in various types of industries.

2. Attempt to work out uniformity in job terminology to facilitate the work of an employment service.

Findings or recommendations upon all matters must be the practically unanimous decision of all concerned—mutuality is necessary to maintaining good faith and practical results.

10. *Variables in Industrial Psychology*

W. V. BINGHAM, "Achievements of Industrial Psychology," *Mental Hygiene*, 14:379-381 (1930)

One accomplishment of the young science of industrial psychology has been to formulate its problem. Real scientific research consists essentially in finding our precise *relations between variables.* The variables that industrial psychology must analyze, measure, and relate, are (*a*) significant aspects of industrial behavior, and (*b*) factors conditioning this behavior.

This very general formulation of the problem has been made more specific. Personal and social factors, as well as aspects of the physical environment, have to be determined if the causes of industrial behavior are to be understood. Their variety and complexity are seen at a glance in the accompanying partial list of variables in which managers and workers are chiefly interested. [Page 36].

The Field of Industrial Psychology

Variables which Industrial Psychology Undertakes to Measure and Relate

A. *Measurable Aspects of Significant Industrial Behavior*

- Output
  - Quantity of output
  - Quality of output
    - Proportion of spoiled work
    - Excellence of product
  - Variations in output
- Earnings
- Savings
- Absenteeism, lateness
- Labor turnover
- Labor stability
  - Length of service
- Time required to learn
- Rate of advancement
- Health
  - Medical examination data
  - Records of illness
- Safety
  - Accident frequency and severity
    - Lost time; minor mishaps
- Suggestions—number and value of
- Conflicts, individual and group
  - Disagreements; emotional outbursts
  - Acts of insubordination
  - Restriction of output, sabotage
  - Strikes, lock-outs
- Fatigue (decreased capacity)
  - Energy-cost (oxygen consumption)
- Fatigue (feelings of weariness)
- Interest in work
  - Feelings of zest; absorption in task
  - Feelings of boredom, distaste, unrest
- Reveries
  - Grouches, pessimistic ideas, etc.
  - Dreams and hopes
- Morale, labor attitudes
- Satisfaction, contentment

as related to

B. *Factors Conditioning Behavior*

- Fitness for work
  - Individual abilities, characteristics, and desires, such as
    - Age, education, and experience
    - Ambition; interests
    - Emotional stability
    - Intelligence
    - Strength and health
    - Special aptitudes and talents
- Social and economic status
- Training
- Supervision
  - Methods and attitudes of supervisors
- Organization of work
  - Layout, routing, supply of materials, instruction cards
  - Work methods, tools, machines, postures, variety, etc.
- Hours, rest periods
- Work surroundings: lighting, ventilation, noise, music, fellow workers, etc.
- Food, sleep, etc.
- Financial incentives
  - Salary, wages; fairness of rate
  - Method of payment: day wage, piece rate, group bonus, etc.
- Non-financial incentives
  - Supervisory encouragement or drive
  - Approval of fellow workers; honor roll, etc.
  - Graphic record of production
  - Group rivalry, etc.
- Opportunity for advancement
- Uncertainties concerning accidents, health hazards, old age, unemployment
- Miscellaneous: personnel and management policies and methods; provision for participation in management, group insurance, unemployment compensation, etc.
- Life outside of working hours
  - Standard of living
  - Use of leisure
  - Home conditions

This is not the whole picture. Even when each of the humanly and industrially significant effects mentioned in the first column of the table is thoroughly understood in its relation to each of the causes listed in the second column, it still will be necessary to determine interrelationships also. Quantity and quality of goods produced, for example, are determined in part, not only by the ability of the workers, their training, supervision, incentives, and other conditions listed in the second column; they are affected also by regularity of attendance, health, morale, number and severity

of accidents, and other variables appearing in column one. The task, then, is neither easy nor simple.

It does not follow, however, that the problem that faces the industrial psychologist is utterly baffling, and that the methods of science must, therefore, be put aside in favor of shrewd, unaided common sense, or that intuitive, impressionistic executive judgments based on conference and pooled "experience" are superior to precise records, measurement, and controlled experiment. True, the answer in its entirety is not going to be found in this generation, or the next. But already we know that, taking the problem bit by bit, exploring minutely the relations of one of its variables to a few of the others, the findings are often of immediate practical value. They are also steps in advance for the science of industrial psychology.

C. The Problem of Selection and Placement

11. *The Functions and Psychological Problems of a Personnel Department*

B. V. Moore and G. W. Hartmann

The Development of Personnel Departments.—Organized activities relating to workers have come inevitably with social and industrial progress. Civilization's rising standards of humanitarianism have placed social pressure on the employer to provide for the welfare and satisfaction of his employees, and the rising percentage of labor cost in production has forced him to provide for that welfare conducive to efficiency. Concentrated mass production has made the problem more difficult. Before the first industrial revolution the master tradesman had intimate relations with his journeymen and apprentices. When many home industries were transferred to factories with power-driven machinery, the owner-employer still retained his office in the building. By the beginning of the twentieth century, however, many industrial and commercial organizations had grown so large that it was impossible for even the manager representative of owners to know all the employees. To some person had to be delegated the task of looking after those features that would keep the employees on the job and satisfied, and welfare departments appeared here and there in various organizations.

It soon became impracticable to have applicants seeking jobs from the many foremen scattered throughout large plants, so a centralized employment office was established. It was necessary that the person doing the employing should know the nature of

Functions of a Personnel Department

5. In what respects are the engineering and psychological viewpoints identical? In what ways do they conflict?
6. It has often been alleged that applied psychology is simply common sense. To what extent is this true? Does this statement necessarily involve a disparagement of the subject?
7. How does applied psychology differ from pure psychology?
8. What, according to Drever, is the new emphasis in industrial relations which he calls the psychological phase?
9. What does psychology ask of management? What suggestions can you give of ways in which management can meet these demands?

CHAPTER III

POPULAR VERSUS SCIENTIFIC PROCEDURES IN APPRAISING MEN

Superstition is one of the biggest obstacles to the progress of science. All subjects suffer from the prevalence and persistence of numerous erroneous ideas and practices, but psychology seems to be a special victim of current fallacies. The reason for this is not hard to seek. Most men would hesitate to pose as authorities on steam turbines, but rare is the mortal who does not consider himself a sound judge of human character. In the one instance, false pretensions are speedily exposed; in the other, they flourish unmolested. Even among highly trained people there is little recognition that objective checks are applicable to subjective opinions.

The ordinary psychologist resents the necessity with which he is confronted of smashing the plausible systems erected by pseudo scientists. The duty, however, cannot be evaded. A good structure cannot be erected without first clearing the ground of the rubbish and débris of the past. The American Medical Association has to maintain an incessant warfare against quackery, patent medicines, and bogus degrees, in the interests of public welfare. Persons masquerading as "character analysts" and "biopsychologists" can be guilty of almost equal injury. Some, in fact, do more harm. The quack at his worst can hardly do more than receive money without effecting a real cure; but the fake "occupational analyst" may wreck the lives of his clients by recommending an unsuitable career, with all the emotional and intellectual damage which that involves.

The material in this chapter is roughly arranged in the order of frequency with which these various dogmas would be met in the business world. Physiognomy in its protean varieties is probably the most influential and persuasive of all. Once this champion of popular beliefs is downed, the minor adversaries can be quickly eliminated. Stereotypes are readily revealed by experiment, but they will probably persist for generations to

affect for better or worse even supra-individual issues of political and social import. Handwriting tells much about itself but little about the person who produced it; while phrenology is the classic example of an originally sober hypothesis degenerating into a gross foible.

The psychologist cannot content himself merely with a rejection of these false claimants. Just as in the fields of spiritualism and the occult, he must add to this an explanation as to why men are so prone to accept untrue assertions. Illusions as well as correct perceptions have their own natural grounds for being.

A. Physiognomy

1. *Principles of Physiognomy*

JOSEPH JASTROW, *The Psychology of Conviction*, 141-149 (Houghton Mifflin, 1918)

The parent view, that mental traits are conditioned by bodily *composition,* affiliated with views of similar ancestry, holding that the traits were revealed in bodily *signs.* Such is the principle of physiognomy, a doctrine as old as Aristotle, and older. There is the traditional story that the physiognomist Zopyrus, in reading the character of Socrates, pronounced him full of passionate tendencies, thus showing in the opinion of the disciples of Socrates, the vanity of his art. But Socrates came to his defense and confessed the reality of the impulses, which, however, he was able to resist. Aristotle's advocacy of physiognomy was not pronounced; it may have been little more than an inclination to recognize the reflection of emotion in feature, or the coördinate growth of body and mind. But the tractate on "Physiognomy" ascribed to him served as the text to the Renaissance adepts in occult lore. Thus restated, even more than in its original setting, it presents the characteristic dependence upon weak analogy in connecting specific bodily features with specific mental traits. Coarse hair, an erect body, a strong sturdy frame, broad shoulders, a robust neck, blue eyes and dark complexion, a sharp but not large brow, were together regarded as marks of the *courageous* man, while the *timid* man showed opposite characteristics. The doctrine was reinforced by such analogies as that timid animals, like the rabbit and the deer, had soft fine hair; while the courageous ones, like the lion and the wild boar, were coarse-haired.

A mental trait may have at once a natural bodily cause and a

manifest or covert sign. The "humorist" may also be a physiognomist, may both account for and read human character, may prescribe for its ailments according to the one set of influences, and advise as to course and career according to the other.

There is no more instructive instance to illustrate how the old learning was reinstated with slight alteration in precept and practice, than the career of Jerome Cardan (1501-76). Esteemed by his contemporaries, shrewd and able, he was urged in one direction by his taste for science and in another by his credulity. His autobiography reveals his analytic bent as well as his strong personality. It has been said of him that for all for which his contemporaries thought him wise, we should think him mad; and for what we think him wise, they would have thought him mad. So great was his reputation that he was invited and then inveigled to travel from Naples to Scotland to treat the Bishop of St. Andrews. The prelate's ailment had been described as a periodic asthma due to a distillation of the brain into the lungs, which left a "temperature and a condition too moist and too cold, and the flow of the humors coinciding with the conjunctions and oppositions of the moon." With the characteristic prestige that results from finding others in the wrong, Cardan promptly found that the Archbishop's brain was too hot and too dry. He put his distinguished patient on a cold and humid diet to resist the attraction of the brain, yet had him sleep on a pillow of dry straw or seaweed, and had water dropped upon his shaven crown; in addition, however, he prescribed a regimen of simple food, much sleep, and cold showers. The improvement that resulted—naturally ascribed to the "humoral" procedures—added much to the glory of Cardan's reputation and the profit of his purse. This physician, learned and wise for his day, was yet the very embodiment of all things superstitious. Every trivial occurrence was an omen or portent. He cast horoscopes, wrote on all manners of cosmic influences, and espoused the rôle of a physiognomist. His distinctive contribution was an astrological physiognomy, based upon the underlying notion that the furrows or lines of the forehead *correspond* to the seven dominant celestial bodies; and that the qualities which they denoted were those connected with the powers and virtues conferred by Venus, or Jupiter, or Saturn, or Mercury, etc., in the current astrological system. Across the forehead he drew seven parallel lines, the spaces in succession dedicated to the moon and the six planets, and by the proportions and prominences of these lines he read the fortune of the subject, not hesitating in one case to predict from the grouping of these wrinkles that the owner thereof was doomed to die by hanging or drowning.

In such manner the humoral doctrine served to determine the diagnosis of disposition and ailment, while from astrology and physiognomy were drawn further indications of personal character and probable fortune. Hardly less significant for the logical temper of these pre-Harveian days were the contributions of Giovanni Baptista della Porta (1538-1615). He was impressed by the comparative physiognomy sketched in the Aristotelian writings—a field in turn indicating the strong impression that the traits of animals make upon the thought-habits of primitive people; it appears in totemic practices, as well as in animal fables from Æsop to Br'er Rabbit. The notion that stubborn persons carry the outward sign of their obstinacy by having features in common with the face of a mule, or that foolish ones show a like resemblance to a sheep, impresses the modern reader as a strange joke. The analogy will barely support a pleasantry or a metaphor. We are fully conscious of the metaphor of our epithets, when we call an obstinate person mulish, or a shy one sheepish, or a man of sly ways an old fox, or speak of a social lion or a wise owl or a gay butterfly; it is significant that what was once serious logic is now playful figure of speech. It is also in accord with the principle of survivals in culture that the notions made current by generations of credulous "physiognomists" continue to be circulated in the popular manuals sold to simple folk to teach them the art of reading faces and futures.

All this would be as irrelevant retrospectively as it is to our central purpose, were it not that it indicates the presence throughout the ages of a considerable body of popular lore and systematized doctrine—both saturated with flimsy analogy and engaging prepossessions—which was available for the ambitious renaissance of the interest in character and its signs in the face, through its best known apostle, Johann Caspar Lavater (1741-1801). The contrast between Lavater and such men as Cardan and Porta is as marked as that of the spirit and scope of the scientific study of their respective times. The vagaries of the sixteenth century may have stood measurably aloof from the real, if slow and uncertain, advances in the knowledge of mind and nature then maturing; but they were not wholly remote, not wholly tangential to its orbit. This was no longer true of the eighteenth century. Lavater, despite his reputation and associations and the imposing effect of his ambitious publications, failed to affect seriously or to divert the increasing stream of scientific discovery to which the early eighteenth century gave momentum. The scientific contemporaries of Lavater judged his views as critically, appreciated their wholly subjective basis in a personal predilection and their lack of ob-

jective warrant quite as justly as we of today. The contrast of attitude appears equally in the all but complete desuetude of the old persistent pseudo-sciences, astrological and others.

Lavater had nothing new to offer in principle or data or method. He was an impressionistic enthusiast, setting forth conclusions with a minimum of argument and convictions with a minimum of proof. His system was based upon subjective interpretation. His delineation of character was a direct reading of detailed mental traits by an interpretation of their equivalents or representatives in features and expressions. Lavater's activities were manifold. Preacher, orator, philanthropist, political reformer, dramatist, writer of ballads, he was a conspicuous man of his times, highly regarded by his eminent contemporaries—among them Goethe, whose contributions to the "Fragments of Physiognomy" have been identified. He was quite without scientific bent or training. Yet his name was so commanding in the annals of physiognomy as to distract attention from the slightness of the foundations upon which his elaborate superstructure was raised. Indeed, the impressiveness of elaborate plates and luxurious editions, and the support of distinguished but uncritical patrons, were responsible for much of his fame. The reader who desires first-hand acquaintance with Lavater must be prepared for tedious assertion, for generalities that do not even glitter, for persistent avoidance of real issues, for the futile contention and misunderstanding of a propagandist. Of method he had little, and for the most part translated directly and by use of a dictionary or fanciful etymologies, from the language of a superficial anatomy into that of a wholly arbitrary psychology. He presented a popular, empirical grouping of feature-interpretation by virtue of a certain common-sense shrewdness, which he elevated to the dignity of a universal physiognomical sense—"those feelings which are produced at beholding certain countenances, and the conjectures concerning the qualities of the mind," which the features suggest. The extensive collection of portraits alone offset the tedium of the text. Lavater was an expert draftsman, and a diligent collector of engravings, outline drawings, and the silhouettes then in vogue. To each picture he attached a character-reading, which reflected little more than his personal impression or knowledge of the subject, to which occasionally were added special correlations of such traits as prudence, cunning, industry, caution, determination or what not, with the forehead, the eye, the nose, the mouth, the chin.

It was inevitable that the practical interest, lacking the compensations of Lavater's serious purpose, rapidly turned physiognomy into vulgar quackery. The followers of Lavater developed

a craving for handy recipes by which to interpret the meaning in terms of character, of chin, forehead, eyebrows, and of the several distinctive combinations of feature, by an arbitrary or plausible system of signs. Physiognomy degenerated into a baseless and senseless empiricism. Oblique wrinkles in the forehead were held to indicate an oblique or suspicious mind; small eyebrows with long concave eyelashes were made the sign of phlegmatic melancholia; long high foreheads were advised not to contract friendships or marriages with spherical heads. Such was the detailed but arbitrary correlation oracularly set forth with no more analysis or understanding of facial traits than of mental ones.

Lavater's work supplies a convincing and not too ancient example, if such be needed, of the limitations of impressionism as a basis for the study of character and of its utter futility for the purposes of a sound psychology; and that apart from the like disqualifications resulting from an ignorance of the significance of such somatic features as those which formed the basis of the system. It shows how readily an enthusiastic but unintelligent industry may build a monumental construction upon a hollow foundation. It illustrates as well a specific psychological fallacy: that of exaggerating the significance of traits in which we have an interest. It is the general human appeal of the face and its expression and its place in human intercourse that supplies the interest so readily abused by popular writers or commercial charlatans. It is just this realm of loose analogy and unchecked ambitious conclusions that attracts feeble minds with a taste for speculation and an inclination for the occult, the bizarre, the esoteric; such a taste, as if to appease a neglected, logical conscience, usually finds refuge in a forced semblance of verification. It is this combination of interests that supports physiognomy or phrenology, palmistry or fortune-telling, and (with an altered complexion) Christian Science or Theosophy,—in which latter examples cures or miracles instead of readings supply the realistic support.

2. *The Pseudo-Science of Physiognomy*

H. L. HOLLINGWORTH, *Vocational Psychology and Character Analysis*, 34-40 (Appleton, 1929)

Very often practicing phrenologists and phrenological vocational experts seek to justify their operations and pretensions by pointing out that they do not rely solely on the cranial geography, but more often on other characteristics of the individual's body, such as the concavity or convexity of his profile, the shape of his jaw, the texture of his skin, the shape of his hands, the color of his hair

and eyes, the proportions of his trunk. Contemporary vocational counsellors who have enjoyed some vogue and commercial repute are especially given to citing these criteria; several recently published tables of these clues are available. Historically, the attempts to formulate principles of physiognomy antedate phrenology by many centuries. Logically, however, physiognomy follows phrenology, as a transition from the formulation of structure to the formulation of behavior. There is a very widespread belief that many mental and moral characteristics betray themselves in special facial items. The shifting eye, lofty brow, massive jaw, thin lips, large ear, protruding or receding chin, dimple, wrinkle, tilted nose, thin skin, prominent veins, and many other characteristics have come, in fiction and in tabletalk, to symbolize specific characteristics. The same thing is true of the shuffling gait, the erect body, the protruding paunch, the curved shoulders, enlarged knuckles, stubby or elongated fingers, the short neck, the long arm, and the manner and rate of stride. It is but a step from these to the signs afforded by clothing, its selection, care, and mode of wearing.

Here is indeed a most confused mass of fact and fancy which finds credence in varying degrees on diverse occasions. Seldom has it been analyzed into the definite types of material which it really contains, and its evaluation is commonly left to the haphazard opinion of each individual. There is no doubt that we all tend to form our opinion of a stranger's probable characteristics partly on the basis of these physiognomic, physical, and sartorial factors. To what degree can these items be formulated so as to afford reliable criteria in the analysis of personality, as in the case of vocational selection and employment? We may perhaps best answer this question by noting the various sources of the belief in the validity of physiognomic and similar signs.

1. It is first of all true that many of these marks are the result of habitual activity, and in so far as they originate in the expression of a trait, they may be said to be signs of it. That the studious come to be round-shouldered, the cheerful to have smooth countenances, the guilty to have furtive eye-movements, may well be expected. But it is quite another thing to reverse the proposition and to take stooped shoulders as a universal sign of academic interests, dimples as a sign of guilelessness, and nystagmus as the symptom of a criminal past. It is, however, often safe to use these traits as reliable signs of the established general habits and attitude which they express. We have all done this since earliest childhood; yet any attempt to classify formally the signs and effects of habit and constant expression would be pedantic. Unfortunately for the

purposes of vocational guidance of youth, these expressions require for their formation habits of fairly long standing, and the critical period for psychological guidance is likely to be passed long before these settled habits have set the features into their identifiable molds.

Somewhat more hopeful is the reliance on expressive movements as indicative of passing and transient emotional states and attitudes. Not easily can we conceal from the astute observer the momentary passion that may be stirring us. Prolonged intimate acquaintance with an individual's emotional experiences and expressions may in time reveal to an observer the deeper lying and more permanent affective trends, the moods and sentiments which indicate what we are accustomed to call the temperament of the individual. Insight into the nature of these expressive movements is one of the useful things to be derived from long and patient study of human nature, both at first hand and through the classical descriptions of emotional expression. The more one observes and the more individuals he observes, the more he is impressed with the final variety and informal complexity of these expressive movements, and their dependence on a vast detail of circumstance, which again forbid rule-of-thumb formulation.

2. Another apparent source of these beliefs is in analogy. The clammy hand, the fishy eye, the bull neck, the "blotting paper" voice, the asinine ear, the willowy figure, the feline tread, and scores of such phrases indicate that these characteristics remind us definitely of various species or objects other than the human being, and that we expect to find back of them the characteristic traits, habits, and instinctive tendencies of those species. We seldom proceed so far as to check up our expectations with facts, under controlled conditions.

3. The affective value of these analogies and their incorporation in poetry, song, and fiction as adequate figures of speech lead us to react to these traits in ways determined largely by the traditional usage. We are humble before the "high-brow," merry in the presence of the dimpled, cautious and prudent before him of the shifting eye. In so far as human reactions are determined by the implied expectations of associates to the demands of immediate circumstances, we should be surprised indeed if the "high-brow" did not, on the strength of his cranium, evade our office-door sentinel, the dimpled one respond to our facetious comment, and he of the shifting eye be forced to steal for a living.

4. Another source of these notions is mainly responsible for such of them as refer to definitely undesirable traits. This is the belief, so well played upon by the school of Lombroso in criminology, that

many of these characteristics, along with the so-called physical stigmata, are indicative of a degenerative or atavistic trend in the constitution of the individual. Among these stigmata were enumerated every conceivable extreme variation of every identifiable part of the human anatomy. Lombroso was inclined to believe not only that the presence of such traits was a certain mark of criminal propensities, but even that various types of criminals could be recognized by the cataloging of their stigmata, as thieves, murderers, forgers. The history of the criticism of this view need not be repeated here. Suffice it to say that we now understand that the underlying truth of the matter is only that these stigmata are somewhat more frequent among the vicious, degenerate, and defective groups than they are among people selected on the basis of their morality and intelligence. The criminally inclined individual may possess no stigmata, while an Abraham Lincoln may possess several of them, and in marked degree. To be sure, when an unusual number of stigmata are presented by an individual, we feel disposed to suspect that the abnormal condition is not confined to his bones and peripheral organs alone, but is probably so deep-seated as to involve his nervous system as well. But on the basis of these stigmata alone we are quite unable to decide whether he is an imbecile, a degenerate criminal, a pervert, a genius, or only an average man, with an undue burden of physical infirmity; still less can we diagnose his special mental or moral qualities.

5. A further source of these physiognomic beliefs may be discerned: namely, the fact that the features of a stranger are very likely to call more or less clearly to our memory some other acquaintance whose traits we know, to our sorrow perhaps, and whose features or manner or voice or apparel chance to be very similar to that of the stranger. At once we are inclined to endow the stranger with the character of the individual he resembles. We seldom accurately check up these impressions on the basis of subsequent discovery. Indeed we are much more likely to evoke the suspected traits by our own attitude and by our treatment of the stranger, and we are eager to pounce upon any act that may be construed as a confirmation of our snap judgment. It is obvious that these impressions will vary from individual to individual and that any attempt to formulate them would expose their fallaciousness.

6. Finally, in this analysis of the origin of our belief in the signs of physiognomy, is the mere insistence that as a matter of fact there are definite relationships discoverable and formulable between typical features and typical characteristics of personality. Beliefs of this dogmatic kind are most likely to be exploited by

the professional counsellor, since they appear to the examinee to be unknown, mysterious, esoteric facts. The following formulations, taken from an account of the performance of one of the most widely advertised of professional vocational counsellors, may serve as an example of this type of dogmatic physiognomic doctrine:

The sensitive, delicate-minded man usually has a fine-textured skin; the coarse-minded man a coarse-textured skin. It is an embryological fact that the skin was and is the original seat of all sensations, and that spinal cords and nerves are but modified and specialized in-turned skin. Of necessity a man's skin indicates the texture of his brain.

Texture is a great classifier of humanity. The individual of fine hair, fine-textured skin, delicately chiseled features, slender, graceful body and limbs, as a general rule, is refined, loves beauty and grace, and likes work either purely mental in its nature or offering an opportunity to handle fine, delicate materials and tools. On the other hand the man with coarse hair, coarse-textured skin, and large, strongly formed features inclines as a general rule to occupations in which strength, vigor, virility, and ability to live and work in the midst of harsh, rough and unbeautiful conditions are prime requirements.

3. *Character Analysis*

HUGO WESTERBERG, *System of Character Reading*, 2, 3, 7, 19, 29 (privately printed and distributed)

The basic principle followed in reading character at a glance—both desires and emotional traits—is that the ownership of a special tool implies the wish and ability to use it for the class of work it is fit for. If we find a man in possession of a set of carpenter's tools we know he works in wood, while if he has a blacksmith's outfit he will be working in metal. When someone has provided himself with a garden spade he does not as a matter of fact intend to dig a ship canal, which, however, might be the case if he operates a steam shovel.

Looking at the mechanical equipment for satisfying our desires, we may, therefore, reasonably expect to learn something about the relative strength and direction of each tendency involved in deciding our conduct. . . .

The system divides character traits into three groups: *Desires,* which furnish the driving power back of our actions; *Intellectual Traits*, which serve as guides in the choice of actions; and finally, *Emotional Traits*, which have an influence on the manner of operation of desires and intellect. . . .

Extended observations will show that the one desire, the state or condition of which is of permanent importance even to members

of highly civilized races, is the *Desire for food.* Food supplies the energy required for uninterrupted life and growth of the individual. Around this desire the great and small activities of man have been carried on throughout history, receiving therefrom, directly or indirectly, their strongest and most enduring motive power. The whole structure of present-day business has been built up to permit every human being to acquire sufficient nourishment safely and without too many hardships or dangers.

The power and capacity of the food desire in a person is estimated by looking at the visible part of the equipment for consuming food—that is, the mouth. The circular muscle opening and closing the mouth shows by its form and size the condition of the food desire as being very forceful, normal, or lacking driving power. In application, the desire for food appears as acquisitiveness in general, and means not only an appetite for real food ready to eat right away, but a hunger for things that can be exchanged for food at some future time, or that will assist in obtaining it. Such things are, money and property of all kinds, or position and business connections that assure a satisfactory supply thereof. The desire for food, in short, is the *desire for personal gain.*

The construction of the mouth muscle shows most clearly in the side view, and approaches one of two extremes. It may form heavy, protruding lips or thin straight up and down lips. It should be noticed that the red part of the lips are not expressive of the food desire, and therefore should be ignored in the estimate thereof. . . .

Studying the amœba, we notice that in taking action toward the satisfaction of the desire for food it seems to be able to exercise choice based on information received through the contact of a feeling member with foreign matters.

This power to distinguish between things that are useful and things that are dangerous to its well-being is instinct, the first appearance of intellect in animal evolution. Gradually through the development of more efficient and far-reaching means for getting information, intellect in its highest form, judgment, becomes possible. In man the working parts of intellect are sense organs, the brain and other parts of a nervous system and the glandular structures. For our present purpose, to learn to judge the mental characteristics of an individual at sight, we are through lack of knowledge of visible symptoms of the last restricted to whatever the shape of the sense organs and the brain can tell. By applying the previous mentioned principle that an organ is a tool for a certain purpose and the mechanical arrangement thereof indicates the way the owner will use it, to the findings of psychology and physiology,

we will learn to recognize some of the important factors that concern man's thinking ability. . . .

The expression of desires, as well as the operation of the intellect are accompanied and influenced by hereditary modes of response, the nature of which are indicated by the arrangement of various parts of their physical equipment. These tendencies are caused by strains and stresses in the mechanism and constitute the basis for our emotional traits.

"Sensitive" means quickly affected by the attitude of others.

"Critical" means ability to perceive the fitness of things as well as incorrect arrangement of them.

These traits always go together with the desire for information and are indicated by a very pointed nose tip.

When dealing with a man of this type it should be remembered that he is easily hurt by slights and insults even if not intended. He is interested in constructive ideas and the improvement of conditions, but is rather thin skinned and apt to lose heart when rebuffed or treated rudely. He should learn to disregard bad manners and other unessential faults in people.

"Unimpressible" is the opposite of sensitiveness.

"Indifferent" is the negative of critical.

These traits go with a lack of desire for information and are indicated by a well rounded nose tip.

When dealing with a person of this type you need not fear to be your natural self because the man is very tolerant of the shortcomings of others and not readily irritated.

A man with this trait will find it easy to mix with all kinds of people and preserve his peace of mind. He can go about his work without feeling personally concerned with the wrong-doings of those he comes in contact with. He should guard against being too complacent with regard to business methods and should try to practice constructive criticism when needed.

4. *Blond and Brunette Traits*

D. G. PATERSON and KATHERINE E. LUDGATE, "Blond and Brunette Traits: a Quantitative Study," *Journal of Personnel Research*, 1:122-127 (1922); reprinted by permission of Williams & Wilkins Co.

Dr. Katherine M. H. Blackford, in describing blond vs. brunette characteristics states: "In brief, always and everywhere, the normal blond has positive, dynamic, driving, aggressive, domineering, impatient, active, quick, hopeful, speculative, changeable and variety-loving characteristics; while the normal brunette has negative, static, conservative, imitative, submissive, cautious, painstaking, pa-

tient, plodding, slow, deliberate, serious, thoughtful, specializing characteristics."

The generalization quoted above sums up the first one of the nine physical variables (1) color, (2) form, (3) size, (4) structure, (5) texture, (6) consistency, (7) proportion, (8) expression, (9) condition, which constitute the fundamentals for the analysis of human character in the Blackford employment scheme.

Furthermore, Dr. Blackford assures us that her law of color is simple and straightforward. To quote: "In applying this law of color to people of the white race, the method is simple. The less the pigmentation in any individual, the more marked will be the characteristics of the blond in his physical, mental and psychical nature; the greater the degree of pigmentation, the more marked the characteristics of the brunette."

The above quotations give us the setting of the quantitative study here reported. It is assumed that the traits assigned to blonds and the traits assigned to brunettes will be interpreted uniformly by intelligent, educated adults. At least we must believe that Dr. Blackford makes this assumption for she does not consider it necessary to define or describe any of these traits. It is also assumed that intelligent, educated adults are capable of picking from among their acquaintances at least two pronounced blonds and two pronounced brunettes and that such adults are also capable of judging the existence or absence of each trait in a given individual. Such assumptions are reasonable enough in the light of Dr. Blackford's assurance that the method of applying the law of color is simple.

With these considerations before us, we should experience little difficulty in putting Dr. Blackford's generalization to the acid test. If blonds as a group, always and everywhere, possess or exhibit traits that are positive, dynamic, driving, etc., then blonds individually should possess such traits. And if blonds individually possess such traits, then we should expect at least a large majority of them to be rated by intelligent, educated judges as being the possessors of those traits. On the other hand, intelligent, educated judges should rate the large majority of blonds as deficient in the brunette traits. The opposite results should hold, of course, in securing ratings on brunettes.

The Rating Sheet.—In order to secure ratings of blonds and brunettes by intelligent, educated adults we prepared a rating form which was distributed to each of 94 judges. Each of these 94 judges was asked to pick out from among his acquaintances two pronounced blonds and two pronounced brunettes and to proceed to rate them with respect to each of the characteristics according

to the directions given at the top of the rating sheet. The list of traits or characteristics was purposely arranged in a random order. That is, blond traits and brunette traits were thoroughly shuffled so that none of the judges would be able to tell from the order of the traits which were the blond traits and which were the brunette traits. None of the judges, so far as we are aware, had ever made any detailed study of Dr. Blackford's scheme of character analysis. Shuffling of the traits in the list was therefore probably effective in forestalling the effects of suggestion that might be present were the judges aware that certain traits are supposed to characterize blonds and certain other traits to characterize brunettes. In our opinion the 347 blond and brunette ratings are entirely free from prejudice for or against Dr. Blackford's blond vs. brunette analysis and they are also uninfluenced by any knowledge of the purpose prompting this study. Each judge was instructed to make out and submit his ratings independently.

The Judges.—The 94 judges who coöperated in making the ratings reported here were mature university students enrolled in a course in psychology. These students belong to the brightest 50 per cent of students who enter the university. On an intelligence scale for the population at large these students would be rated as "superior" or "very superior" in intelligence. On such an intelligence scale these students would equal the brightest 10 per cent of the entire adult population of the United States. From the standpoint of educational status, these students would also rank exceptionally high, being more favored in the way of educational advantages than 96 per cent of the adult population. We are confident, therefore, that our judges are sufficiently intelligent and educated to apply Dr. Blackford's law of color with high degree of reliability and accuracy.

Results.—The ratings for blonds and brunettes were tabulated separately and the percentage of blonds rated plus in each trait and the percentage of brunettes rated plus in each trait was then computed. These computations are shown in Table I and are presented graphically in the accompanying chart. It is obvious that these so-called blond and brunette traits fail to differentiate real flesh and blood blonds and brunettes. On the contrary we find that the percentage of brunettes possessing the blond traits is fully as large as the percentage of blonds possessing blond traits. Furthermore the percentage of blonds possessing brunette traits is also very similar to the percentage of brunettes possessing brunette traits. These results are in flat contradiction to the results one has a right to expect if Dr. Blackford's generalization is true. The bar diagrams, shown on the chart, for blonds and brunettes

are very similar from trait to trait, the divergences between the length of the bars being conspicuous because of their absence. The similarity is very close as shown by a correlation of + 0.96. It is probable that such small divergences as are found here would disappear if the bar diagrams were based on ratings of 1,000

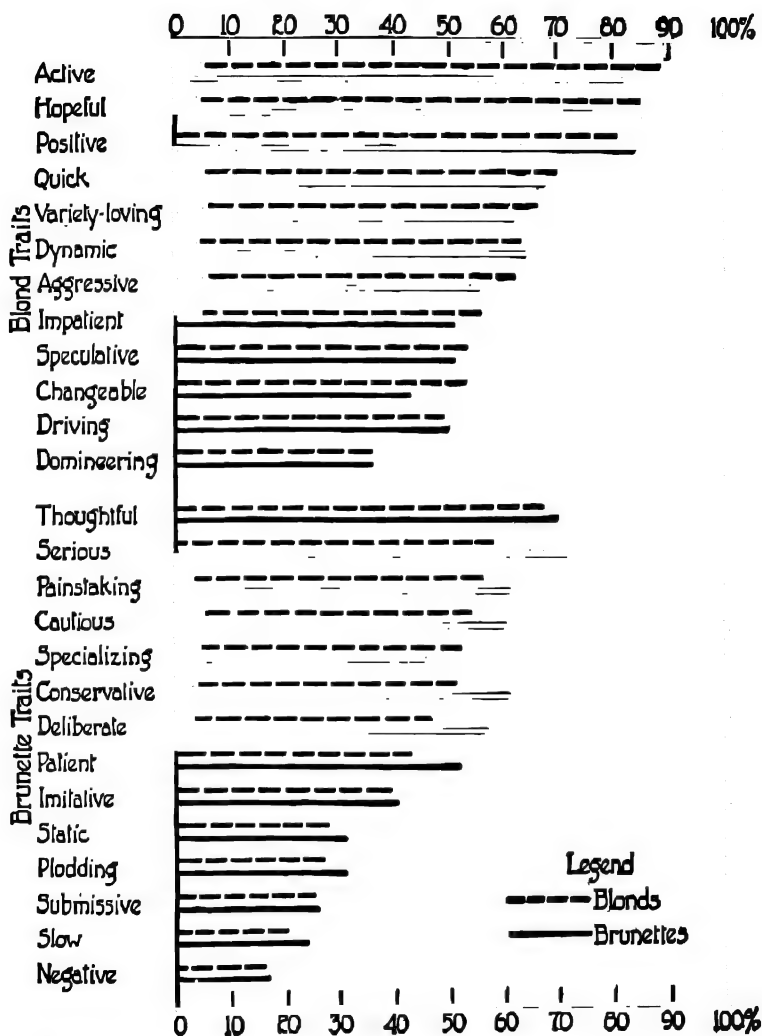
TABLE I

PERCENTAGE OF BLONDS AND BRUNETTES RATED PLUS IN EACH TRAIT

Traits	187 Blonds	187 Brunettes
Blond traits		
Positive	81	84
Dynamic	63	64
Driving	49	50
Aggressive	62	56
Domineering	36	36
Impatient	56	51
Active	88	82
Hopeful	85	85
Quick	70	68
Speculative	53	51
Changeable	53	43
Variety-loving	66	62
Brunette traits		
Negative	16	17
Static	28	31
Conservative	51	61
Imitative	39	40
Submissive	25	26
Cautious	54	60
Painstaking	56	61
Patient	43	52
Plodding	27	31
Slow	20	24
Deliberate	47	57
Serious	58	72
Thoughtful	67	70
Specializing	52	45

blonds and 1,000 brunettes instead of on the basis of 187 blonds and 187 brunettes.

It is reasonable to suppose that marked differences might have been disclosed even though Dr. Blackford's grouping of the traits was incorrect. Even though no real differences exist between blonds and brunettes in such traits, still it is possible that common beliefs concerning blonds as contrasted with brunettes might exist

in which case our curves might be quite divergent. The similarity of the blond and brunette curves seems to show that there are no marked differences between blonds and brunettes in these traits and

PERCENTAGE OF BLONDS AND BRUNETTES RATED PLUS IN EACH TRAIT

further that there is no organized or systematized common belief concerning difference between blonds and brunettes. If such a common belief does exist, the traits listed by Dr. Blackford fail to disclose it.

Sex Differences.—A word is in order concerning an analysis of the ratings from the standpoint of (1) the sex of the judges and (2) the sex of those rated.

In brief it may be said that no significant sex differences were disclosed. In terms of correlations the results are:

(1) SEX OF JUDGES

Correlation between female and male judges rating male blonds. + 0.88
Correlation between male and female judges rating male brunettes ....+ 0.82
Correlation between male and female judges rating female blonds ....+ 0.82
Correlation between male and female judges rating female brunettes ....+ 0.93

These correlations are very high and indicate that there is little difference between the ratings made by male and female judges in rating either male or female blonds or brunettes.

(2) SEX OF THOSE RATED

Correlation between male blonds and female blonds rated by judges of both sexes.......................................+ 0.87
Correlation between male brunettes and female brunettes rated by judges of both sexes.......................................+ 0.91

These correlations are also very high indicating the lack of any significant sex difference among blonds and brunettes with respect to the possession of the traits listed by Dr. Blackford.

5. *A Careful Study of Physiognomy*

W. H. SHELDON, "Ability and Facial Measurements," *Personnel Journal* 6:102-112 (1927); reprinted by permission of Williams & Wilkins Co.

The problem of correlation between physical and mental traits has occupied the attention of a fairly large group of investigators since the development of mental tests and kindred devices for measuring intelligence. Especially fascinating is the notion of the possible existence of relations between ratios of head and face measurements and mental abilities, as well as between ratios of general bodily measurements and mental abilities. If the morphological index really bears a general relationship to intelligence, then it is reasonable to assume that other ratios can be found which will show relationship, if not to psychological test scores, at least to *some* measures of mental ability. Some of these ratios

conceivably might show higher correlations with intelligence test scores than does the morphological index. It is especially likely that some of these physical measurements, or ratios between them, might bear demonstrable relations to social abilities. . . . It is commonly supposed that an individual's physical makeup affects his social behavior more observably and measurably at least, than it affects his intelligence.

A great variety of head and face measurements have been assumed by character analysts and others to bear such definite relations to various character traits and social traits, as to be usable even for individual diagnosis. A number of investigators have attempted to pin down and check some of these assumptions, but their reports have been uniformly negative. No scientific investigator, so far as I know, has reported finding any significant relations of this nature. But these investigations have been notably incomplete, and sometimes made under definitely negative biases. It certainly has not been proved that some relations do *not* exist, and consequently the assumptions persist. The only answer to the problem lies in further evidence. There is still a need for disinterested statistical study of possible relations between accurate physical measurements of this sort, and the best available measurements of social traits.

The objective of . . . the present study was to examine the possibility of relations between certain head and face measurements and proportions, on the one hand, and social traits and mental abilities, on the other. The chief problem in this connection was the establishment of a technique for making head and face measurements which would differentiate between very fine variations, with a minimum of error. One essential to such a procedure appeared to be that the measurements be made at the leisure of the examiner —a condition evidently not possible in measuring men directly. Consequently it was necessary to devise a method by which measurements could be made indirectly, without loss of accuracy.

Apparatus for Making Head Measurements.—In order to serve this purpose, a kind of photographic apparatus was devised. This consisted of a specially constructed chair with a head rest which could be adjusted to hold a student's head in a fixed position by applying contact at four points. This made it possible to photograph the head with distance from the camera and both horizontal and vertical movement controlled. The apparatus was also equipped with a device which made possible a frontal and profile photograph of a subject without moving the camera or changing the subject's relation to the chair. Thus the investigator was able to make comparative three-dimensional measurements of any de-

sired area or distance on the photographed surface, at any time or place. . . .

The measuring was done by placing the negative over an illuminated ground glass screen. First, the points between which measurements were to be taken were located and marked by needle pricks on the negative. Then the points of a pair of very fine dividers were inserted in two of these holes, and the distance between them was measured. This distance was translated directly into millimeters by applying the dividers to the scale, which had been photographed into the picture.

The assumption seemed justified that length or vertical distances on the face and head were accurately represented in the profile photographs, and likewise, that breadth, or horizontal distances measured on the frontal photographs, were accurately representative of true distance between points on the face and head. In view of the fact that length measurements taken from the frontal photographs were subject to some degree of error, none of these measurements was used in the investigation. Likewise no breadth or horizontal measurements from the profile pictures were used.

Measurements Used.—The photographs of one hundred men were used in the investigation. These were all freshmen whose morphologic measurements had been taken, and who had been rated on five social traits. . . . Twelve measurements were taken. These may be described as follows:

1. Head length (HL). The maximum length of the head. The shortest distance between the glabella and the occipital point, i.e., between the prominence of the forehead immediately above the nose and the most projecting point at the back of the head. Taken from the profile photograph.
2. Head breadth (HB). The maximum breadth of the head, above the back of the ears. From the frontal photograph.
3. Head height (HH). The vertical distance of the center of the external auricular meatus below a horizontal plane tangential to the top of the head (from the profile photograph). In taking this measurement, the meatus is first located; then a horizontal line is drawn on the negative, tangential to the top of the head, by means of a small steel L-square and the sharp point of a small pen-knife; then a line through the meatus is drawn perpendicular to the horizontal head-tangent. The distance between the meatus and the intersection of these two lines is the head height.
4. Facial length (FL). The shortest distance between the nasion point (at the angle between the nose and the forehead), and the gnathion point (the point at the center of the angle of the chin). Taken from the profile photograph. The nasion point can generally be located very easily by inspection; the gnathion is somewhat more difficult but

after a little practice it can be located with only slight probability of error.

5. Facial breadth upper (FBU). I am applying this term to what Goring and others call the facial breadth. Goring defines the measurement as "the maximum breadth of the face, between the most prominent points on the right and left cheek bones." Taken from the frontal photograph.

6. Facial breadth lower (FBL). In order to get a comparison between the upper and lower breadth of the face, I took this measurement, arbitrarily defining it as the length of the horizontal line between the two extreme points on the right and left side of the face, at the level of the mouth. From the frontal photograph. In practice I found it convenient to think of this line as that horizontal line which divides the mouth into two equal parts, rather than as the line passing through the horizontal axis of the mouth. This is because of the fact that most mouths are neither symmetrical nor horizontal.

7. Eye width (EW). This was an easy measurement from the frontal photograph. It was taken between the pupils, which showed very clearly in the negatives as two dots about the size of pin holes. The "eye width" was the distance between the centers of these two dots.

8. Nose length (NL). The distance between the nasion point and a point at the center of the angle at the end of the nose, as seen in the profile. Taken from the profile photograph. The nasion point has already been located. The center of the profile angle at the end of the nose can likewise be located by inspection without difficulty after a little practice.

9. Chin projection (CP). A perpendicular distance between two vertical lines, one of which passes through the external auricular meatus, and the other through the most projecting point on the chin. Taken from the profile photograph.

10. Nose projection (NP). Same as 9, except that the second vertical line passes through the most projecting point on the nose.

11. Forehead projection (FP). Same as 9, except that the second vertical line passes through the most projecting point on the forehead.

12. Neck thickness (NTh). The mean of the shortest anterior-posterior and the shortest transverse thicknesses of the neck. The anterior-posterior measurement was taken from the profile photograph, and the transverse measurement from the frontal photograph.

In addition to these 12 measurements the following 15 combinations and ratios were used:

13. Cephalic index (Ceph.I). Head breadth × 100 over head length (Goring).

14. Head volume (HVol.). Head length × head breadth × head height.

15. Facial index (F Ind.). Facial breadth × 100 over facial length × 2. The facial breadth used here was my facial breadth upper (Goring).

16. Facial length over head volume (FL/HV).
17. Facial breadth lower over facial breadth upper (FBL/FBU).
18. Eye width over head volume (EW/HV).
19. Eye width over facial breadth upper (EW/FBU).
20. Eye width over facial breadth lower (EW/FBL).
21. Nose length over head volume (NL/HV).
22. Nose length over facial length (NL/FL).
23. Nose length over facial breadth upper (NL/FBU).
24. Nose length over facial breadth lower (NL/FBL).
25. Forehead projection over chin projection (FP/CP).
26. Nose prominence (N PROM.). This ratio represents the amount of projection of the nose over and above the averaged projection of the chin and forehead. I arrived at it by using the formula 2NP — (CP + FP) where NP is nose projection, CP is chin projection, and FP is forehead projection.
27. Neck thickness over head volume (NTh./HV).

To test the reliability of these measurements, the photographs of 12 men were re-measured and the results compared with the first measurements. There were thus 144 pairs of measurements to be compared. Of these 144 pairs, differences were found in only 5, the difference being in each case, one millimeter. Such close agreement seems at first remarkable, but it is easily accounted for by the fact that the measurements were in each case taken between the same needle pricks in the negative.

There were in all twenty-seven variables in this group. These were correlated with each of the five social traits, and with two criteria of mental ability (scholarship grades and psychological test scores). The remainder of the present section of this study will be devoted to an examination of correlations (1) between these head and face measurements and social ratings; and (2) between the measurements and intelligence criteria.

Head and Face Measurements and Social Ratings.—Correlations in this group are shown in Table I. [Page 64.]

This group of 135 correlations looks rather disappointing at first glance. There are no really high relationships, and there are many which are close to zero. Eight are higher than 0.20, and 58 are higher than 0.10. Only four in the group exceed three times their probable errors. These are:

Sociability—head length
Sociability—neck thickness
Leadership—facial breadth lower
Agressiveness—facial breadth lower

Twenty-four of the correlations exceed twice their probable errors. The column headed sociability contains nine of these,

leadership has eight, aggressiveness four, perseverance three, and emotionality none. There are 43 negative correlations, but only two of them exceed twice their probable errors. There is a general tendency toward (1) positive correlations between four of the social traits and all of the measurements, (2) negative correlation between these four traits and the measurement ratios, and (3) negative correlation between emotionality and the measurements. Again, as in the preceding section, the traits sociability, leadership, and aggressiveness show this positive correlation fairly clearly, while emotionality shows the opposite tendency.

The correlations with gross measurements are almost uniformly positive. Excluding emotionality, only four in 48 are negative. The correlations with ratios however, show a pretty clear bimodal distribution, or rather two separate distributions, one on each side of the zero ordinate. This points very strongly toward the conclusion that the only relationship existing here may be a positive relationship between the social traits and simple physical bigness. Let a represent a measurement correlating relatively high with a particular social trait, s. Let b represent a measurement correlating somewhat lower with the same trait. Then when the trait s is correlated with a/b, a low positive correlation will result. When s is correlated with b/a a negative correlation is found. This apparently is what has happened in this group of correlations. The positive and negative correlations between social traits and ratios may well be due entirely to the a/b and b/a conditions, respectively. Thus nose length and facial length each show a positive relationship with sociability (0.05 and 0.19 respectively). But $\frac{NL}{FL}$ correlates — 0.06 with sociability. Both facial length and head volume correlate positively with the same social trait (0.19 and 0.22 respectively), but $\frac{FL}{HV}$ correlates — 0.05 with sociability. *That is, it does not seem to be facial length (or any other of these measurements) in proportion to some other measurement that correlates with the social traits. It seems to be large features in general that correlate with these traits. . . .*

Table I will repay careful inspection. Some of these measurements are much more definitely related to social traits than others. All three of the head measurements show fairly uniform positive correlations with the first four social traits, and they all show a slight negative correlation with emotionality. Head volume, derived from these three, is related negatively with aggressiveness, as well as with emotionality. The three facial measurements (FL, FBU, and FBL) show a distinctly higher positive relationship to the social traits all along the line, and the negative rela-

tionship with emotionality is less marked. The correlations between facial breadth lower and the first four social traits are among the highest in the group. These four correlations average 0.211. There is some truth in the notion that "open-faced" or wide-faced people are rated higher on these social traits, than are narrow-faced people.

For eye width the same general facts hold, but to a less extent.

TABLE I

CORRELATIONS BETWEEN SOCIAL RATINGS AND HEAD AND FACE MEASUREMENTS (100 CASES)

	Sociability	Perseverance	Leadership	Aggressiveness	Emotional Excitability
MEASUREMENTS					
Head length	0.267	0.105	0.190	0.024	— 0.086
Head breadth	0.092	0.081	0.183	— 0.034	— 0.006
Head height	0.064	0.093	0.041	0.056	— 0.104
Facial length	0.189	0.205	0.093	0.039	— 0.088
Facial breadth upper	0.096	0.124	0.209	0.080	0.017
Facial breadth lower	0.174	0.114	0.304	0.250	0.021
Eye width	0.030	0.198	0.102	0.017	— 0.053
Nose length	0.051	0.086	0.138	0.120	— 0.070
Chin projection	— 0.154	0.041	0.213	0.178	— 0.006
Nose projection	0.002	0.083	0.116	0.031	0.026
Forehead projection	0.046	0.002	— 0.033	— 0.007	— 0.064
Neck thickness	0.269	0.132	0.192	0.098	0.073
RATIOS					
Cephalic index	0.162	— 0.044	— 0.116	0.153	0.086
Head volume	0.218	0.170	0.050	— 0.125	— 0.130
Facial index	0.072	— 0.099	0.088	0.164	0.095
FL/HV	— 0.048	— 0.065	0.035	0.187	0.024
FBL/FBU	0.128	0.068	0.175	0.141	0.104
EW/HV	— 0.198	0.087	— 0.128	— 0.126	0.130
EW/FBU	— 0.122	0.141	— 0.195	0.086	— 0.058
EW/FBL	— 0.182	— 0.098	— 0.097	0.147	0.113
NL/HV	— 0.050	— 0.078	— 0.150	0.108	0.054
NL/FL	— 0.061	0.048	— 0.064	0.035	0.050
NL/FBU	0.011	0.078	— 0.146	0.136	0.080
NL/FBL	— 0.057	— 0.032	0.097	0.126	0.048
FP/CP	0.184	— 0.035	— 0.116	— 0.147	0.068
2NP — (CP + FP)	— 0.085	— 0.086	0.131	0.064	0.085
Neck Th/HV	0.081	— 0.078	0.075	0.119	0.130

The same is true of nose length. Chin projection correlates — 0.15 with sociability, and rather high with both leadership and aggressiveness. Possibly projecting chins are not particularly well liked. Nose projection and forehead projection show distinctly lower relationships with the social traits than do the other measurements.

The relatively high correlation (0.269) between neck thickness and sociability is one of the most interesting in the group. Thick necks seem to be quite popular. This measurement also correlates relatively high with the other four social traits.

Head and Face Measurements and Intelligence Criteria.—These correlations appear in Table II. These correlations are distinctly lower than the other group. Only two of the 54 exceed twice their probable errors. These are head length and grades, and head height and psychological test. All three of the head measurements show a slight positive correlation with both of the intelligence criteria. Head volume, however, shows practically a zero relationship here.

The three face measurements correlate uniformly *negatively* and very low with the intelligence criteria. Facial breadth lower, the measurement showing the highest correlation with social traits, correlates — 0.05 with the psychological test scores, and — 0.02 with scholarship.

Eye width shows no relation with grades, and only 0.07 with the psychological test. Nose length correlates practically zero with both criteria. Nose projection, however, shows a correlation of 0.10 with the psychological test, and 0.05 with grades. Chin projection shows practically nothing here, but forehead projection, strangely enough, correlates negatively (— 0.12) with psychological test scores and — 0.07 with grades. This, upon examination of the correlation sheets, proved to be due to the influence of about six cases of markedly protruding foreheads accompanying low intelligence.

Neck thickness shows no relation to either of the intelligence criteria, although it correlated relatively high with the social traits.

The correlations between the intelligence criteria and measurement ratios show uniformly nothing. Most of them are less than their probable errors, and not one is twice its probable error. They are about half negative, and their mean is — 0.012.

Conclusions.—This section of the study seems to throw little light on the problem, beyond a tendency to support the findings of Pearson and others who have reported slight positive correlations between all three of the head measurements and intelligence. My correlations are slightly higher than those Pearson found, but the number of cases is too small for great significance.

The fact that none of the ratios bears any significant relation-

ship with intelligence points strongly to the conclusion that here as well as in the case of the social traits the relation that *does* exist is much more likely to be a correlation of the criteria with *general physical development* (of the head, in this case) than with

TABLE II

Correlation between Head and Face Measurements and Intelligence Criteria (100 Cases)

	Psychological Test	Grades
MEASUREMENTS		
Head length	0.097	0.137
Head breadth	0.051	0.106
Head height	0.174	0.078
Facial length	—0.008	—0.044
Facial breadth upper	—0.079	—0.092
Facial breadth lower	—0.052	—0.021
Eye width	0.065	0.002
Nose length	0.029	—0.035
Chin projection	—0.041	0.054
Nose projection	0.099	0.053
Forehead projection	—0.117	—0.067
Neck thickness	0.040	—0.054
RATIOS		
Cephalic	—0.038	—0.042
Head volume	0.015	0.062
Facial index	—0.009	—0.011
FL/HV	—0.043	—0.104
FBL/FBU	0.033	0.033
EW/HV	—0.014	—0.037
EW/FBU	0.051	0.094
EW/FBL	—0.031	—0.052
NL/HV	0.022	—0.049
NL/FBU	—0.024	—0.004
NL/FBL	—0.080	—0.042
FP/CP	—0.054	—0.054
2NP — (CP + FP)	0.078	0.002
Neck Th/HV	0.003	0.002

the special development of some anatomical feature. The only fact I have found which seems to contradict this conclusion is the slight negative relationship between intelligence and the measurements of facial breadth. For this relationship I know of no explanation. Perhaps the character analysts can make some use of it.

The following general conclusions seem justified by the facts presented in this section:

1. There is a fairly definite, low positive relationship between all of the measurements of the face and head, and the four social traits, sociability, perseverance, leadership, and aggressiveness. Clearly the factor size, or general physical development of the head and face, is positively related to these social traits. The relationship is of course very slight, and undoubtedly of less importance than several other factors influencing an individual's behavior.

2. The correlations between the social traits and measurement ratios or proportions are uniformly lower than correlations between social trait and the simple measurements. Sociability and the other traits tend to accompanying *not* a long face, or a wide face, or a long head, *in proportion to* head volume, or some other measurement, but these traits tend to accompany *any largeness of feature* whatever.

3. There is a low negative correlation or no correlation at all, between most of the head and face measurements, and emotionality.

4. There is a low positive relation between intelligence and all three of the principal head measurements, namely, head length, head breadth, and head height.

5. There is a very low negative relation between intelligence and the principal face measurements, namely, facial length and facial breadth.

6. No relation could be found between intelligence and head and face measurement ratios or proportions.

7. The possibility of curvilinear regression was carefully checked. No non-linear relations were found.

B. Stereotypes

6. *Stereotypes and Mental Effort*

WALTER LIPPMANN, *Public Opinion*, 89-90 (copyright, 1922, by The Macmillan Co.); reprinted by permission

Modern life is hurried and multifarious, above all, physical distance separates men who are often in vital contact with each other, such as employer and employee, official and voter. There is neither time nor opportunity for intimate acquaintance. Instead we notice a trait which marks a well-known type, and fill in the rest of the

picture by means of the stereotypes we carry about in our heads. He is an agitator. That much we notice, or are told. Well, an agitator is this sort of person, and so *he* is this sort of person. He is an intellectual. He is a plutocrat. He is a foreigner. He is a "South European." He is from Back Bay. He is a Harvard man. How different from the statement: He is a Yale man. He is a regular fellow. He is a West Pointer. He is an old army sergeant. He is a Greenwich Villager. What don't we know about him then, and about her? He is an international banker. He is from Main Street.

The subtlest and most pervasive of all influences are those who create and maintain the repertory of stereotypes. We are told about the world before we see it. We imagine most things before we experience them. And those preconceptions, unless education has made us acutely aware, govern deeply the whole process of perception. They mark out certain objects as familiar or strange, emphasizing the difference, so that the slightly familiar is seen as very familiar, and the somewhat strange as sharply alien. They are aroused by small signs, which may vary from a true index to a vague analogy. Aroused, they flood fresh vision with older images, and project into the world what has been resurrected in memory. Were there no practical uniformities in the environment, there would be no economy and only error in the human habit of accepting foresight for sight. But there are uniformities sufficiently accurate, and the need for economizing attention is so inevitable, that an abandonment of all stereotypes for a wholly innocent approach to experience would impoverish human life.

What matters is the character of the stereotypes, and the gullibility with which we employ them.

7. *Mental Habits that Limit Judgment*

S. A. Rice, "Stereotypes," *Journal of Personnel Research*, 5:268-276 (1926); reprinted by permission of Williams & Wilkins Co.

What Lippmann calls "stereotypes" or "pictures in our heads" concerning the supposed appearance of individuals of a certain race, class, occupation, or social group, may determine to which of these groups the original of a photograph is unconsciously referred by the examiner. The supposed grouping or type in turn suggests the temperamental or intellectual qualities which are believed to characterize it. It is probable that such stereotypes are largely dependent upon superficial ear-marks as the cut of the hair, the mode of wearing the collar and tie, and other modes of dress.

The experiments described below were designed to show the

existence of stereotypes concerning the supposed appearance of persons of various social types, or having defined social functions. These were undertaken originally for purposes of class-room illustration. The participants in various phases of the experiments were, first, 258 undergraduates of Dartmouth College, in small classes, over a period of two years. Subsequently, the assistance of 31 members of the Norwich Vermont Grange, attending a regular meeting, was procured to provide comparative results.

In an edition of the Boston *Herald* for December 15, 1924, were found nine portraits of persons represented in the day's news. The reproductions were unusually clear and were uniformly about two by three inches in size. They were placed without identification upon a sheet of paper and numbered from 1 to 9. The individuals pictured were as follows: Edouard Herriot, at that time Premier of France; James Duncan, Vice-president of the American Federation of Labor; Leonid Krassin, first Ambassador of the Soviet Government to Paris; Joseph W. McIntosh, Deputy Comptroller of the Currency; Martin H. Glynn, former Governor of New York; Max Agel, arrested as a bootlegger; Charles M. Schwab, of the United States Steel Corporation; Howard Heinz, manufacturer of food products; and Senator George Wharton Pepper, of Pennsylvania. In the first aspect of the experiment, the subjects were informed that the sheet contained the pictures of a bootlegger, a European premier, a labor leader, a bolshevik, a United States Senator, an editor-politician, two manufacturers, and a financier. They were asked to identify these individuals by number. Care was taken that no suggestion be given in the instructions concerning the order of the photographs, and that each examiner make independent selections for each position. Table I gives the result of the attempted identifications by 141 students. The numbers are not uniform in each column for the reason that in a few cases the pictures were known to the examiners, while in a few others no identifications were attempted.

Allowing for the fact that *two* manufacturers were included among the portraits, the total number of correct identifications on a chance basis would have been approximately 168. The actual number of correct identifications was almost exactly double that number, or 337 out of a possible 1,224. On a scale between the expected or chance number and the maximum possible number of correct identifications, the excess number of correct identifications was 169 out of 1,056, or 16 per cent. However, such a measure as this percentage provides would not give comparable results as between different series of portraits.

Interest attaches to the fact that Herriot, Duncan, Glynn, Agel,

Schwab and Heinz were related each to his respective status in a number of cases substantially above the chance number. Krassin, McIntosh, and Pepper were below or equal to chance or expectation.

TABLE I

IDENTIFICATION BY 141 STUDENTS

ATTEMPTED IDENTIFICATIONS FROM THEIR PHOTOGRAPHS OF THE SOCIAL TYPE OR FUNCTIONS OF NINE MEN, THE NINE TYPES OR FUNCTIONS REPRESENTED BEING KNOWN

Person Pictured	Identified by the Number of Men Stated as									
	Premier	Labor Leader	Bolshevik	Financier	Editor-Politician	Bootlegger	Manufacturer	Senator	Total	Chance
Premier Herriot........	54	11	55	2	3	4	4	..	133	15
Labor Leader Duncan...	29	25	15	13	14	1	30	9	136	15
Soviet Envoy Krassin..	31	..	9	15	11	..	16	59	141	16
Financier McIntosh....	7	20	14	15	16	24	33	8	137	15
Editor-Governor Glynn..	6	20	5	21	31	2	33	14	132	15
Bootlegger Agel........	1	6	9	4	11	86	18	2	137	15
Manufacturer Schwab...	1	14	4	18	20	2	56	21	136	15
Manufacturer Heinz....	5	19	6	31	16	6	46	10	139	15
Senator Pepper........	..	22	15	16	19	11	35	15	133	15

In the case of Krassin, the Soviet Envoy, a wing collar, Van Dyke beard and moustache contribute to an appearance that may be described as distinguished, and which no doubt led to 59 identifications as the United States Senator, in comparison with 9 as a bolshevik and none as a labor leader. Senator Pepper received as many or more identifications as labor leader, bolshevik, financier, editor-politician, and manufacturer than he received in his own senatorial capacity. The largest number of correct identifications was made in the case of the alleged bootlegger. This individual alone among his associates in the gallery, is pictured in out-door costume. He is shown in a heavy overcoat with up-turned collar, a cap, tortoise-shell glasses and cigar gripped firmly between his lips. It is interesting that while Mr. Duncan was identified by 25 men as the labor leader, he was selected by 29 as the premier, by 30 as a manufacturer, by 15 as a bolshevik and 13 as the financier. It is evident that he did not fit definitely into any

pronounced stereotype among those called forth by the characters enumerated.

When a comparison of the preceding data is made with that obtained from the group of grange members and presented in Table II, the correspondence is seen to be fairly close. Among the latter the total number of correct identifications on a chance basis would have been 29½ out of a possible 219. The correct identifications actually number 58, or again almost exactly twice the expectation. Herriot, Agel, Schwab and Heinz, as among the students, were correctly identified in more than the chance number of cases, while the distribution in other respects shows a close parallel, especially in the high proportions of correct identifications of the bootlegger, and incorrect identifications as Senator or the Bolshevik envoy.

It is evident that some measure of the extent to which opinion has concentrated in the identification of each portrait would be useful. Wherever there is concentration among the identifications, whether these be correct or incorrect, there will be evidence of the existence of a common stereotype concerning the social designation to which the portrait is assigned.

TABLE II

IDENTIFICATION BY 25 GRANGE MEMBERS

Person Pictured	Identified by the Number of Members Stated as									
	Premier	Labor Leader	Bolshevik	Financier	Editor-Politician	Bootlegger	Manufacturer	Senator	Total	Chance
Premier Herriot.......	8	3	14	..	..	..	..	..	25	3
Labor Leader Duncan...	10	1	3	2	3	..	3	2	24	3
Soviet Envoy Krassin...	1	1	..	1	..	..	2	21	26	3
Financier McIntosh....	..	8	4	3	4	..	5	..	24	3
Editor-Governor Glynn..	2	5	..	3	3	..	9	1	23	2½
Bootlegger Agel........	..	1	1	1	1	22	..	..	26	3
Manufacturer Schwab ..	..	3	1	4	3	..	12	..	23	2½
Manufacturer Heinz....	1	1	..	7	4	2	8	1	24	3
Senator Pepper........	2	2	1	5	3	2	8	1	24	3

Such a measure has been found by calculating in the case of each photograph the total and the relative differences between the numbers of identifications made for each social designation (i.e.,

under each column in Tables I and II) and the corresponding numbers that would be expected on the basis of chance. For example, the chance number of identifications for Premier Herriot in each column of Table I would be 15. The differences between the chance and the actual numbers of identifications are respectively 39, 4, 40, 13, 12, 11, 26, and 15. These total 160. But since the chance number in the case of each portrait is derived from the total number of identifications of that portrait and is a function of the latter, the aggregate number of differences so determined may be related in each case as a numerator to the total number of identifications as a denominator. This fraction, when converted to a decimal figure, will provide a relative *index of departure from expectation.* This index will serve one of the purposes of a *coefficient of variation,* for by its use it is possible to compare the relative concentration of opinion concerning each portrait in the two groups providing data.

In Table III, there is shown for each group the total departures from chance expectation, the indexes of departure from expectation, and the rank of the nine portraits according to the latter. It will be noted that a high total departure and a high index within each group, and a high index in either group, denote a relatively high degree of concentration of opinion, i.e., of agreement among the examiners.

When the corresponding indexes shown in Table III are compared it is observed that in each case those for the grange group are higher. This indicates that within the latter there is a greater concentration of opinion. If the thesis of this article is correct, it indicates that members of the grange are more prone to form their identifications upon the basis of stereotypes than are the students.

The order of rank among the nine portraits in the matter of concentration of opinion is closely similar in the two groups. When correlated by the well-known Spearman formula the coefficient of correlation, $r = 0.84$. Herriot, Krassin and Agel occupy first, second or third position in both groups, though it was only in the case of Agel that the centering of agreement among the examiners took place upon the correct identification.

The appearance of each of these men as portrayed could be described for one reason or another as striking, in comparison with the others. In the case of each, it is safe to assert, one or more stereotypes, held in common among the judges, were evoked. With each stereotype, moreover, it seems likely that characteristic mental and moral qualities supposed in a similar stereotyped fashion to accompany it were suggested to the judges, and seen inferentially in the corresponding features.

TABLE III

TOTAL DEPARTURES FROM EXPECTATION, INDEXES OF DEPARTURE FROM EXPECTATION AND RANK ACCORDING TO THE INDEXES, IN THE CASE OF IDENTIFICATIONS OF NINE PORTRAITS BY STUDENTS AND BY GRANGE MEMBERS

Person Pictured	Students			Grange Members		
	Departures from Chance	Indexes of Departure	Rank	Departures from Chance	Indexes of Departure	Rank
Premier Herriot..	160	1.20	1	34	1.36	3
Labor-Leader Duncan	47	0.35	7	17	0.71	5-6-7
Soviet Envoy Krassin	119	0.84	3	37	1.42	2
Deputy Comptroller McIntosh...	34	0.30	8	17	0.71	5-6-7
Ex-Governor Glynn	63	0.48	5	14½	0.63	8
Bootlegger Agel..	140	1.02	2	39	1.50	1
Manufacturer Schwab	78	0.57	4	18½	0.80	4
Manufacturer Heinz	66	0.47	6	17	0.71	5-6-7
Senator Pepper...	36	0.27	9	11	0.46	9

In an effort to check this assumption, a further step in the experiment was taken by securing ratings of the sort obtained by Hollingworth. Students who had not hitherto acted as judges were used as subjects. However, it is probable that interest in the previous experiments had already been aroused outside of the classroom among some of the subjects and that a number had an impression in consequence that there was a catch in the directions given. The same group of grange members as before was employed for comparison, all phases of the experiment being carried through upon a single occasion.

In the case of the students, three groups of judges were used. Each was requested to grade the nine portraits, first, according to intelligence; second, according to craftiness. The latter was defined as that characteristic, the possession of which would lead to the taking of an unfair advantage in a business negotiation. The first group of judges, 47 in number, were given no statement concerning the identity of the men portrayed. The second group, 31 in number, were misled by a set of false identifications, conforming so far as possible to the major erroneous identification in the earlier part

of the experiment; that is, with an incorrect stereotype. These false identifications were as follows: Herriot as Bolshevik, Duncan as European Premier, Krassin as United States Senator, McIntosh as manufacturer, Glynn as financier, Agel as manufacturer, Schwab as editor-politician, Heinz as labor leader and Pepper as bootlegger. The third group, 39 in number, were shown the portraits accompanied by real identities.

In the case of the grange members, the group was first asked to grade the nine portraits according to intelligence, without any identifications being given or suggested. After a lapse of time during which identifications were attempted by the members themselves they were asked to fold their papers in such a way that the first series of grades would be concealed. The correct list of identifications was then placed beside the portraits and they were asked once more to re-grade the portraits in intelligence without reference to their earlier gradings. The circumstances and the time allotted did not permit of gradings upon craftiness, or of gradings upon an erroneous set of identifications. Eighteen papers on which the grading and re-grading were both carried through were received.

TABLE IV

PERCENTAGE RATINGS OF NINE PORTRAITS ON INTELLIGENCE BY STUDENTS AND GRANGE MEMBERS, AND ON CRAFTINESS BY STUDENTS, UNDER CERTAIN VARIABLE CONDITIONS CONCERNING IDENTIFICATION

Person Pictured	Percentage Ratings on Intelligence					Percentage Ratings on Craftiness by Students		
	Students			Grange members				
	No statement	False identity	True identity	No statement	True identity	No statement	False identity	True identity
Herriot	40.7	54.0	62.2	30.5	73.0	63.5	50.7	49.4
Duncan	33.4	43.0	25.6	35.5	54.9	52.1	58.9	50.6
Krassin	69.8	78.3	69.2	79.0	34.0	30.3	29.4	30.4
McIntosh	53.0	45.6	61.9	52.8	54.9	54.0	56.0	57.4
Glynn	65.1	68.2	57.5	41.0	59.0	29.3	39.1	47.8
Agel	31.3	30.3	6.4	27.7	13.2	57.5	65.3	68.0
Schwab	60.2	52.0	70.9	69.5	72.2	46.3	39.1	41.4
Heinz	58.8	54.0	58.0	70.2	50.0	54.8	52.0	53.0
Pepper	36.7	28.8	39.2	45.1	51.2	61.7	61.4	51.0
Mean Deviation...	12.8	12.0	17.6	15.8	12.6	10.9	10.5	6.8

In aggregating the ratings in each case, an arbitrary system of weighting was employed, in accordance with which the picture rated highest was valued at 8 each time it was placed in this position. The second position in the rating was valued at 7, and so on down to the last or ninth position, which was valued at 0. The possible aggregate rating, therefore, ranged from 0 in the event that a certain picture was in each case rated ninth in the series, to a figure amounting to the product of eight times the number of ratings given—a figure possible of attainment only in the event that a given picture was in each case rated first in the series. The aggregate rating actually received by this method, when related to the maximum possible rating as a percentage of the latter, affords a basis of comparing the valuation placed upon the various circumstances indicated.

The changes in percentage ratings on intelligence when the true identities were disclosed, as compared with those made without statement or suggestion concerning identity, are as follows:

	Students	*Grange Members*
Herriot	+ 21.5	+ 42.5
Duncan	− 7.8	+ 19.4
Krassin	− 0.6	− 45.0
McIntosh	+ 8.9	+ 2.1
Glynn	− 7.6	+ 18.0
Agel	− 24.9	− 14.5
Schwab	+ 10.7	+ 2.7
Heinz	− 0.8	− 20.2
Pepper	+ 2.5	+ 6.1

In Table IV these percentage ratings only are presented, both for the students and for the grange members in the case of intelligence, and for the students alone in the case of craftiness. It should be noted particularly that *three groups of individuals* are referred to in the case of student rating, while the grange ratings are made in both cases by the *same* individuals. However, the variable conditions indicated by the column headings "no statements" and "true identity" are as near as possible alike in both cases.

Table IV and the changes in rating under variable conditions indicated therein seem to indicate that ratings on intelligence and craftiness from photographs are influenced by the assumed or known identity or social type of the individual portrayed, that is, by the stereotype of such a person in the mind of the judge. Disclosure of the true identities of the nine men portrayed led to changes of rating in the same directions among both students and grange members, except in the case of Duncan, labor leader, and

Glynn, ex-Governor. It seems clear that among these nine individuals those whose positions or names in the business or professional world carry prestige, particularly McIntosh, Schwab and Pepper, tend to improve their ratings in intelligence and (except in the case of McIntosh) decrease them in craftiness as their identities become known. The loss of Heinz in intelligence rating is only an apparent exception to this, for the mistaken identifications in this case were very largely for positions in the series which carry prestige. That is, no added impression of high social position was given by a disclosure of his identity. On the other hand, the declines in intelligence rating for the bootlegger and the bolshevik are striking, the former most noticeably among the students and the latter among the grange members.

Comparisons running counter to *a priori* anticipation include that for Krassin, who among the students rates but slightly higher in craftiness when known as a bolshevik than when falsely represented to be a United States Senator. Nor do the data always appear consistent, as when the students rate Duncan higher in craftiness when alleged to be the Premier, while Herriot rates lower in the same characteristic when actually identified as the real holder of this position. But other variable factors of explanation may enter here; moreover, it must be remembered that the numbers of judges are small.

Some of the more general conclusions suggested by the preceding data may be summarized:

1. The existence of common stereotypes concerning the appearance of various classes of persons (senators, bootleggers, etc.) is clearly indicated. These led to numerous errors of judgment.

2. The stereotypes found among students and grange members were similar, but there appeared to be a somewhat greater uniformity (concentration of judgment on the basis of a stereotype) among the latter.

3. Estimates of intelligence and craftiness, presumably based upon the features portrayed, are in reality influenced by the supposed identity of the portrait, i.e., by the stereotype of the supposed occupational or social status held in the mind of the examiner.

The implications suggested are both theoretical and practical. The data serve to emphasize the inescapable bias of preconception to which everyone is subject. Stereotypes afford a necessary economy of effort in the process of cataloging our environment. We take note of an actual or alleged association, which may be wholly fortuitous, among the attributes of an individual. From this we generalize and assume a constancy of the association. The appearance of another individual presenting a few of the attributes

so associated leads us to believe that we recognize in him the other attributes as well.

The process of filling out our actual sense perceptions in this manner takes place in our face-to-face estimates of other people, no less than in the case of estimates made indirectly from photographs. The distorting effect even upon work which is presumed to be scientific may be given a further illuminating illustration: In his study of the criminal, which followed Lombroso in assuming the existence of an anthropological criminal type, Havelock Ellis presented a series of sketches of criminals made from life by Dr. Vans Clarke, a prison governor. They were alleged to be "by no means very exceptional," representing "at least 10 per cent of the criminals examined."

The widely known Goring report reduced these sketches to a composite portrait, which evidenced features of a highly abnormal appearance. Beside this it placed a composite portrait made from an equal number of photographs selected at random from the official stock of photographs of a prison population. The features in the second case show no appearance of abnormality. The report comments: "An examination of these contrasted outlines shows most strikingly the differences between 'criminal types,' as registered by the mechanical precision of a camera, and as viewed by the imagination of an enthusiastic, but uncritical, observer." In other words Dr. Clarke's sketches were biased in a constant direction—the direction of his stereotype of the men before him.

Similarly one is made skeptical of attempts to derive scientific generalizations from biographical data concerning historical personages. One enthusiastic writer has referred to biography as "the one ripe and ready field for the study of physiognomy." "A tabulation of the faces and figures of eminent personages should long ago have suggested itself as desirable, if not indispensable."

It is to be supposed that even contemporary biographers are fully as subject to stereotypes concerning their heroes as was Dr. Clarke with reference to the prisoners under his charge.

When individuals are in face-to-face contact there is usually an opportunity for the more erroneous stereotypes possessed by either concerning the other to be corrected in the process of becoming acquainted. First impressions are modified by conversation and other expressions of personality. When personality is judged by photographs, or by first uncorrected impressions of appearance, on the other hand, it is inevitable that striking errors will be made. It seems evident that a method of arriving at judgments concerning the character of fellow men or women, sufficiently realistic to serve as a basis for an employment policy, for example, cannot lean

heavily upon photographs. The discovery and complete elimination of stereotypes is not wholly possible, but its approximation can probably be attained only as the result of face-to-face interstimulation and response.

C. Graphology

8. *The Claims of Graphology Investigated*

C. L. Hull and R. B. Montgomery, "An Experimental Investigation of Certain Alleged Relations Between Character and Handwriting," *Psychological Review*, 26: 66-68, 73 (1919)

The present experiment seeks to test the truth of certain graphological theories, i.e., certain correlations alleged to exist between specific traits of handwriting and traits of the writer's character. Obviously the reasons given by graphologists for their findings may be either more or less accurate than the findings themselves. The traits of character investigated were chosen as being at once associated with traits of handwriting which were susceptible of objective measurement and being among the less improbable of the relations alleged. They are shown in the following table together with the trait of writing most commonly supposed to indicate each:

TABLE I

Traits of Character and Handwriting

Trait of character	Trait of handwriting
Ambition	lines of writing sloping upward
Pride	lines of writing sloping upward
Bashfulness	writing traced with fine lines
Force	(*a*) heavy lines, (*b*) heavy bars on the *t*'s
Perseverance	long bars on the *t*'s
Reserve	closed *a*'s and *o*'s

The subjects were 17 students of the University of Wisconsin, all members of the same medical fraternity. Each man was first asked to write, in his ordinary manner, a paragraph from a popular magazine. The writing was done in each subject's own room, at his regular desk and with his own pen. . . . The material written is as follows, the parentheses indicating particular *m*'s, *n*'s and *t*'s which were measured:

It see(m)ed to be a big (t)own; he wo(n)dered just why, in all his days, he had never made more (t)han four or five (t)rips to Brooklyn, but he did not wo(n)der for lo(n)g. His heavy (t)houghts dragged back to his own plight a(n)d the call just ahead of him.

Cus(t)om a(n)d frie(n)dship co(m)bined would deprive him even of the fee he was about to earn. Not so much as the wre(t)ched car-fare he was spe(n)di(n)g would be his reward for a(tt)e(n)di(n)g the suf-feri(n)g me(m)ber of the Ca(tt)erson fa(m)ily. In the ma(tt)er of plain mo(n)ey profit, Brooklyn so far measured up to the Hallas s(t)a(n)dard in every respect.

When the writing was finished the subject was given a set of sixteen small cards, each card bearing the name of one of the other subjects. The card bearing the subject's own name was left out. He was directed to arrange the cards in the order of the amount of ambition possessed by the person indicated on each. . . . The rank thus given each subject was recorded on a special blank by the experimenter, after which he shuffled the cards with care. This process was repeated with each of the traits of character listed in Table I and with each of the subjects. . . .

From the 17 rankings thus obtained, the average position of each subject in each trait was found. The subjects were then re-ranked in each trait according to the size of these averages, the smallest (i.e., highest) average rank in a given trait being 1, the next smallest being 2, and so on. . . .

It was next necessary to secure corresponding rankings with respect to the various traits of handwriting supposed to be correlated with the respective traits of character. This was done by measuring the various traits of handwriting involved and then ranking the subjects on the basis of these measures. . . .

A brief summary of the correlations obtained is presented in

TABLE II

CORRELATIONS OF CHARACTER WITH HANDWRITING

Ambition with upward sloping lines	—.20
Pride with upward sloping lines	—.07
Bashfulness with fineness of line	—.45
Bashfulness with lateral narrowness of *m*'s and *n*'s	+.38
Force with heavy handwriting	—.17
Force with heavy bars on *t*'s	—.06
Force with heavy bars on *t*'s, varying size of handwriting compensated for	+.27
Perseverance with length of bars on *t*'s	.00
Perseverance with length of bars on *t*'s, varying size of writing compensated for	+.16
Reserve with closed *a*'s and *o*'s	—.02

There appear in this table fully as many negative correlations as positive. The average of the entire ten is —.016, or practically zero. And since the above are a fair sample of graphologists' claims

as to the relation between handwriting and character, the figure may be taken with some assurance as typical of the whole.

As an interesting check upon the technique employed, an equal number of correlations were computed from pure empirical chance. Symmetrical lotto blocks numbered from 1 to 17 were shaken thoroughly in an improvised dice box, thrown upon a table and arranged in a row by mechanical methods. The numbers of the blocks were recorded in the order thus appearing just as if representing the ranks of the subjects in a trait of character. The blocks were then shaken for about a minute, arranged in a row as before and the number recorded, this time as if ranks of subjects in a trait of handwriting. Then the correlation between the two orders was computed by Spearman's formula exactly as in the regular experiment. The following successive correlations were obtained by this means: +.22, —.23, +.07, +.10, —.17, —.07, +.19, —.26, +.47, —.15. The large positive correlation of +.47 which it is possible to obtain by this means should be compared with the correlations of +.38 and —.45 in Table II. The average of the group as a whole is +.017, which may be compared with a similar average derived from Table II.

D. Phrenology

9. *Present Day Rôle of Phrenology*

By courtesy of Philadelphia *Public Ledger*, November, 1929. (Copyright, 1929, by Philadelphia *Public Ledger*)

Phrenology backed by cold facts has played its part in sending Clifford Thompson to the death chair at Milledgeville, Ga.

On the other hand, this same science, which seeks to read character in the shape of the skull, was considered before a stay of sentence was granted to Thompson's pretty wife, Eula, as she stood upon the threshold of the death chamber.

Months ago, both Thompson and his wife and a Negro named Jim Hugh Moss were convicted of the murder of Coleman Osborne, of Chatsworth, Ga., and were sentenced to be electrocuted. Appeals for a new trial delayed the execution of the sentence, but an adverse decision by the higher courts of the State finally put an end to such hopes, and a plea for clemency was made to Governor L. G. Hardman. Phrenology and a new theory concerning fingerprints then entered in the case. . . .

Together with the Prison Commission's recommendation, Governor Hardman also considered pictures and fingerprints of Eula Thompson furnished at his request by the identification bureau

of the Atlanta Police Department. Cold facts, including certain new evidence in the case, plus the commission's findings, were the matters to which the Governor attached chief importance. But after weighing such legal considerations, he turned to a study of Eula Thompson's character and intelligence as revealed through the shape of her skull and the markings on her finger tips—those identifying lines which are never the same in any two people born on earth. His decision was that the pretty mountain girl should not pay with her life for the crime committed a year ago at the little store near Chatsworth, Ga. . . .

"After the technicalities connected with law in the most aggravated cases of crime have been threshed out by all the courts," explained Governor Hardman, "the next feature that stands out is the mentality of the individual. The law provides that he shall be of a sound memory, a disposing mind, and capable of discerning between right and wrong and its effect.

"Since there is no positive proof or examination that determines the mentality, it becomes a question of opinion between experts. These opinions are more or less influenced, unconsciously, by conditions and relations that may exist between the experts, the court and the criminal. Then it must be apparent that in order that exact justice may be done by the courts, as relates to the criminal and the crime, we must have some definite way of measuring mentality. At the present time it is a matter of judgment rather than of positive facts or knowledge."

Having reached this conclusion, Governor Hardman decided that the answer to his problem must lie in physical aspects of the criminal himself, and to his knowledge of phrenology and physiognomy he added the study of fingerprints.

"The fingerprint is so individual," he continued, "that no two alike have ever been discovered. Hence, it seems reasonable to suppose that some dominant characteristic of the individual must be responsible for this fact.

"The shape of a man's head, his features, his handwriting and his voice are also guides to his mentality and his moral quality," continued Governor Hardman. "In my practice of medicine I found that my knowledge of phrenology and physiognomy helped me to size up a patient and in that way to arrive at a more definite diagnosis of his illness. Later on, in business life, my habit of studying faces was a valuable aid to me in gauging the men with whom I dealt, both employees and executives. In selling cotton I talked a great deal over the telephone, and when a man called me up I made it a practice to listen almost as carefully to the tone of his voice as to what he said. The volume, the pitch and the

quickness with which he spoke always gave me a good picture of him, his type and his views."

Among the condemned prisoners whom Governor Hardman has visited and studied in jail was Harold Hammond, later executed for murder when the Governor refused to interfere in the case. Hammond's voice was one thing about the prisoner which impressed Governor Hardman.

"It was the peculiarity of the prisoner's voice which enabled witnesses to identify him," said the Governor, "and it was the quality of the voice which first struck me as a sign of weak moral fiber. I found that Hammond's skull measured twenty-two inches in circumference, and that the back and base of his neck indicated destructibility and lack of caution."

After stressing the fact that the findings of the Prison Commission and all legal aspects of a case meet with paramount consideration from him, Governor Hardman concluded by saying:

"When experts are called into court to testify, they sometimes tell you that the criminal has the mind of a 12-year-old boy. I have been interested in knowing how they reached this conclusion, and I have been impressed with the fact that experts often disagree. It comes down finally to a matter of one man's judgment. If we can find some definite clue through the individual himself by which his character and mentality may be measured, then we will have gone a long way toward establishing a real standard of justice."

10. *Assumptions and Errors of Phrenology*

H. L. Hollingworth, *Vocational Psychology and Character Analysis*, 29-34 (Appleton, 1929)

Underlying all of the various phrenological systems were four common assumptions which, briefly stated, were:

1. That such cerebral localization as exists is of fundamental and specific traits of character or types of ability, such as secretiveness, circumspection, love of babies, generosity, veneration, constructiveness.

2. That the more developed any one of these given traits is, the larger will be the supposed area of the brain which contains its supposed organ.

3. That since the skull fits fairly closely to the brain surface, the relative development of a given portion of the brain will be indicated by the relative prominence or size of the different parts of the cranium, so that the degree of possession of the trait may be judged from an examination of the exterior of the skull.

4. That the occasional casual observation of coincidence between

particularly marked mental qualities and particular cranial characteristics is a sufficient basis for inferring universal and necessary connection between these two features.

Each of these assumptions involves obvious error and misapprehension in the light of what is now known concerning the nature of the human mind and the structure and functions of the brain. In order that these fallacies may be clearly disclosed the four main assumptions will be examined independently in the order in which we have here presented them.

1. In the first place the only sort of localization of functions that has been authentically established is the projection, upon the brain structure, of the other parts of the organism, and the localization of sensori-motor centers which function in the connection of these various organs. Thus it is known that each of the principal groups of muscles of the body has its so-called center in the brain. From this part of the brain to the muscles concerned run bundles of motor-nerve fibers, so that activity in that particular part of the brain may result in the conduction of nervous impulses to these muscles, and in their consequent contraction. Thus the hand, the foot, the eyes, the speech organs, may be said to be functionally represented, and in this sense localized, in particular regions of the brain. The same thing is true of the sense-organs, as the eye and ear. Each incoming sensory nerve tract runs to or through some portion of the brain. Injury to this part of the brain results in functional incapacity of the corresponding sense-organ. The cortex, or outer surface of the brain, may thus be conceived as a sort of terminal station for nerves from other portions of the organism, a sort of projection center which enables them all to take part in a functional unity of action. The functions which can be said in this sense to be localized in the brain are such sensory-motor capacities as the ability to raise the right arm, the ability to balance the body when standing erect with eyes closed, the ability to see, the ability to move the eyeball, the ability to feel pain in a certain area of the skin, the ability to articulate words, to understand spoken or written language, to call up a visual memory of a particular thing previously seen, and the like.

The integrity of various parts of the brain is essential to the proper coördination of all the sensibilities and responses of the individual. Traits of character and types of ability, however, depend on the characteristic modes of reaction of the organism as a whole to the factors of its environment. Thus generosity as a human trait does not depend on the massiveness of any set of muscles, nor on the keenness of any sense-organ, but upon the characteristic type of reaction and motivation which the individual

as a whole displays. Jealousy, love of children, destructiveness are characteristic modes of behavior of the whole organism, and depend upon reactions which the given situation evokes, and not upon some special organ.

2. As to the supposed correspondence between size and functional capacity, no evidence has been presented which demonstrates that even the strength of a muscle or the keenness of a sense-organ depends in any way on the absolute size of the brain-area concerned with it. Nor has evidence been presented to prove the existence, within any given species, of correlation between volume, shape, or weight of the brain-tissues and even the more general traits of character or ability. In the absence of such evidence we are led to believe that functional capacity depends on complexity of structure, chemical, molecular, and functional, rather than on the factors of mass or shape. But even the nature of these correlations is as yet largely unknown. The persistence of the faith in the significance of mass and shape probably rests in part on the apparent existence of such correlation when different species are roughly compared with one another. Thus, among the higher vertebrates there seems to be a relation between what we may call the general intelligence of the species and the erect carriage of the body. From the quadrupeds, with their horizontal position, through the apes, with their semiperpendicular mode of life, to the human being, with his erect carriage, there is also a progression in prominence of the forehead, opposition of thumb and finger, relatively greater development of the cerebral mass, and also in mental capacity. The intelligent human being walks in a more erect posture than does the stupid ape. But no one has ventured to assert that a relation exists between erectness of carriage and mental ability when human beings are compared with one another, or when apes are compared with one another. Similarly in the case of the physical features of the brain, the crude relationships which exist empirically, as between different species, seem to be quite slight in significance when compared with the differences in chemical, molecular and functional complexity which are found among members of the same species. Atttempts to discover correlations between mental and moral characteristics and various brain constants we may expect to continue for a long time. What discoveries may be in store for us we do not know. But the important point in the present connection is that, for the purposes of vocational psychology, the practices of phrenology are based on evidence no more relevant to its pretensions than were the "proofs" pointed to by palmistry, horoscopy, and prenatal magic. Through cranial measurements alone it is impossible to determine with certainty the

race, age, or sex of an individual, or even, indeed, whether he was a prehistoric savage, an idiot, or a gorilla.

3. As for the third assumption of phrenology, namely, that brain development is reflected in the cranial size or protuberances, it should be sufficient to point out that even if this were so it would be meaningless for our purpose, since we are compelled to abandon the belief in a relation between mass of tissue and even the simplest sensory or motor capacity. But such further disproof as may be required is readily furnished by an actual attempt to remove from their cranial boxes the brains of various animals, and by noting that the shape and thickness of the bones give little indication as to whether brain tissue, cerebrospinal fluid, or supporting tissues are to be found underneath a given protuberance or depression.

4. The fourth assumption of phrenology, that sparse and casual observation of striking cases is sufficient ground for generalization, we should be able to dismiss at once as utterly inadequate and miscalculated. It is impossible to find consistent recorded instances in which groups of individuals, selected at random, with definitely determined and measured mental or moral characteristics, have been shown to confirm, by their cranial geography, even the most elementary doctrines of that phrenology which still offers to diagnose the individual's psychic constitution and to recommend to his future consideration the vocation of engineering, publishing, or preaching, as the case may be. Practicing phrenologists have repeatedly been invited to submit one bit of objective evidence for their pretensions, or to submit themselves to tests under controlled conditions. The invitations are refused, and the inquirer is referred instead to the dogma of some foreign and deceased authority. Such investigations as have been recorded have resulted in negative conclusions, or in contradictory data, or in coefficients with such high probable errors as to make the figures unreliable.

11. *Influence of Preperception*

H. E. BURTT, *Principles of Employment Psychology*, 26 (Houghton Mifflin, 1926)

Another principle which is involved in the development of popular physiognomic notions is that we tend to see what we expect to see. If our attention is set for some particular aspect of an object, it is that part which we see first or which impresses us most vividly. In a familiar laboratory experiment in which a pointer swings along a scale and a bell rings at some particular point, if an observer is attending to or thinking about the bell he

will judge that it sounds at an earlier position of the pointer than he will otherwise. Attending to the bell facilitates its entrance into consciousness. Or, again, if one attends to the trombone in an orchestra he can hear it stand out from the other instruments. A motor mechanic will detect a main bearing knock that the layman would overlook because the mechanic takes an attitude of expectation. This principle then operates to substantiate our beliefs in physiognomy. If a person shakes hands weakly we expect that he is going to show some vacillation, and while he perhaps manifests that trait no more than do other persons with whom we come in contact we are all "set" for it in his case and notice instances which would otherwise escape us. Or, if we observe some one with large ears and have been taught that these denote parsimoniousness, we watch for instances which might be construed as manifesting that trait and magnify them, although our friends with small ears may be acting in a similar manner. But once we observe these expected traits they serve further to confirm our generalization, as another case "which proves it."

12. *Testing the False Assumptions*

G. U. Cleeton and F. B. Knight, "Validity of Character Judgments Based on External Criteria," *Journal of Applied Psychology*, 8: 215-216 (1924)

Industry, fully aware of the advantage of an accurate and dependable means of estimating men and women, gives ear to any method of judging character which is at all plausible and which is earnestly presented. At the present time many character analysts, consultants and experts are presenting both plausibly and earnestly methods of judging character based on physical criteria, such as head measurements. Respectable psychology almost without exception repudiates such methods and its foundations on physiological and neurological grounds. . . . But business uses phrenological methods of character judgment rather freely and with some satisfaction. Science and psychology for their own purposes need only theoretical refutation. Business evidently is not sufficiently impressed with theory. Perhaps statistical refutation will help in this connection and round out even the academic treatment of phrenology. This study furnishes such statistical refutation.

Method of the Present Study.—First: Systems of character judgment by external signs were searched to find definite physical traits varying amounts of which are claimed to indicate varying amounts of some character trait. Measurements of such physical traits were made.

Second: Groups of individuals were judged *casually* for specific character traits. There is a possibility that character may be judged by external signs and then the wrong signs reported. That is, by intuition true judgments may be made but the judges are unaware of how judgments are made; and so very naturally report some method.

Third: Close associates who knew the characters of the members of each group carefully rated the members of each group to establish the facts relative to the varying amounts of certain traits possessed by members of each group.

Fourth: The three measurements were correlated.

General Conclusions.—For the busy reader the following contains the meat of this statistical refutation of character judgments by external criteria. The average of 201 correlations between variations in physical traits purported to reveal variation in character traits and our criteria was 0.000 with the correlations varying from 0.000 as chance would account for.

Statistically: In a normal distribution 50 per cent of the cases come within 1 P.E.; 51.24 per cent of the correlations between physical traits and character traits came within 1 P.E. In a normal distribution 82.26 per cent of the cases fall within 2 P.E. Of the 201 correlations reported here 83.08 per cent of them came within 2 P.E. In a normal distribution 95.70 per cent of the cases come within 3 P.E. In this study 98.01 per cent of the correlations came within 3 P.E. In a normal distribution 99.30 per cent of the cases fall within 4 P.E. 100 per cent of the correlations in this study fell within 4 P.E. Statistically, then, the correlation between variations in physical traits and character traits *is* 0.000 (within the reliability of our data).

E. Lower Depths of the Psychological Underworld

13. *Vocational Guidance à la Palmistry*

KATHARINE ST. HILL, *The Book of the Hand*, 259-260 (Putnam, 1928)

The peculiarity of the hands of a good physician is a certain cushioned elasticity of the palm, soft yet very firm, wide with long fingers, a turned back thumb, high Luna and Mercury Mounts. The line of Head ought to be long and sloping, and the third finger dominant. For a surgeon, the fingers should be square and cushioned at the tips, and the hand larger and more supple. The lower Mount of Mars is always well developed in a good doctor's hands, though Mars is not a medical temperament as a rule, the Sun and

Jupiter being the most common. Too much Mercury makes a facetious doctor, and too much Mars a rough one.

There are many kinds of lawyers, and many shapes of hands belonging to them, but, as a rule, their chief feature is the long straight fourth finger, and a wide-stretching supple hand. A good Head line is, of course, necessary for success, and in barristers it should slope on to a good Luna, and the first phalanx of Mercury should be long, which will give the power of speech.

This is not so necessary in solicitors. Nearly all clever lawyers have a forked Head line, so that they can dissemble, and act a part skillfully; a high Mount of Mercury added will give them wit, and a quick gift of repartee. For the rest the hands may be any size, detail may be useful, or the talent for a quick jump to conclusions; they may be any type, though they are not very often spatulate.

The hand of a good Judge is very long, to give him patience, and has a dominant first finger for rule. and he has always a remarkable line of Head.

14. *Mind Reading*

Advertisement selection from a popular magazine.

I CHALLENGE you that I will teach you, by mail, in one lesson, the simplest, shortest method, all for $1.00. Not telepathy. You can read one's mind to a dot, by only looking in the eyes of partner, chum, sweetheart, etc. Praised by New York, Boston, Montreal Police chiefs; colleges, Thurston, Blackstone, etc. If fake, let them arrest me.

F. Scientific Interpretation

15. *The Prevalence of Pseudo-Science*

A. W. KORNHAUSER and A. W. JACKSON, "A Note on the Extent to Which Systems of Character Analysis are Used in the Business World," *Journal of Applied Psychology*, 6:302 (1922)

Workers in the field of applied psychology are frequently called upon to express opinions of so-called character analysis systems. In fact, these systems (especially that of Katharine Blackford) are so widely referred to that a person in contact with managers of sales and personnel is likely to overestimate the extent to which the systems are used. Psychologists not in close touch with business, on the other hand, are even more likely grossly to underestimate the part these pseudo-scientific methods play in the busi-

ness world. No data, so far as we are aware, are available as a basis for estimating the actual extent of the use of character analysis.

A limited questionnaire study was undertaken in order to gain some answer to this question. Two hundred questionnaires were mailed, one hundred to employment managers of industrial plants employing over three hundred workers, and one hundred to insurance agency managers. The companies to which the questionnaire was sent were selected at random within these groups. All were in the city of Chicago. The principal questions on the blank were: "Do you make use of a system of character analysis in sizing up men?" and "What is the name of the system used?" . . . Other questions sought to obtain the individual's opinion of these systems. The position, age, and schooling of the men reporting were also secured.

Sixty-five replies were received, twenty-two from insurance companies and forty-three from the industrial plants. Six of the replies reported the use of some system of character analysis. Four of these were from employment managers and two were from agency managers in insurance companies. Three of the six used the Blackford system; two used a combination of Blackford's system with some other system; one did not specify the system used. Five of the six men reporting the use of character analysis systems are university graduates and the sixth is a high-school graduate.

Six in two hundred is probably a closer estimate of the use of character analysis systems within the groups investigated than is *six in sixty-five,* since persons using such methods would be much more likely to reply than would those acquainted with the systems mentioned in the questionnaire.

16. *Reading Character*

KNIGHT DUNLAP, "Reading of Character from External Signs," *Scientific Monthly,* 15:162-164 (1922)

We may freely admit that certain persons, working in entire independence of any system, may be able to make some good guesses. Many of us think that we can make good guesses. Our guesses are probably very much less accurate than we suppose, yet they may have some validity. In many cases we have to entrust important matters to individuals as to whose honesty or intelligence we have no evidence except from our guesses based on brief observation of the visible appearance of the individual. There is no reason to suppose that professional character analysts should not be able to make as good guesses as anyone else, provided these

experts have the requisite native capacity, and provided that . . . they ignore their systems and use common sense.

It is actually a fact that we do make correct judgments about the transient mental processes of other persons without being able to identify the facts on which these judgments are based. If you are talking to someone, and you say something which offends or grieves or pleases him, you may recognize that fact at once, although it may be impossible for you to designate the exact change in his face or voice or posture which is the basis of your idea. You may even make similar judgments when carrying on a conversation over the telephone, in which case changes in the timbre and inflections of the voice alone could give you the clue. You know from the other person's voice that he is offended or pleased, although you may not be able to identify the exact change in his voice which is the important factor. When you have the visual clues from the other person's face, as well as the clues from the voice, your judgments are more definite and more secure.

This whole matter is but a special case of the more general phenomenon of perception and judgment by sign. It is a fact that in much of our perception we perceive meanings without perceiving the signs on which the perception is based. In some cases, the signs could be perceived, if attention were drawn to them; in other cases, the signs cannot be discriminated even under the best conditions. I shall not go into this topic in an extended way, both because it is familiar to psychologists, and because it cannot be briefly expounded to those without psychological training. I mention it only to show that on this point of character readings we are not dealing with a unique phenomenon, but with a particular manifestation of a general principle which runs broadly through our mental life.

As another illustration of the general principle, I may refer to certain cases of supposed "thought-reading" which are really cases of sign-reading. Many amateurs succeed in catching ideas from other persons, where there is physical relation of such sort that movements of the second person may actually stimulate receptors of the first person, either tactually, visually or acoustically. But these amateurs never succeed if they watch for the signs. They succeed only when they ignore the signs and attend to the meanings. In fact, if amateurs who succeed brilliantly in muscle reading tests become convinced that their performance really is muscle reading and nothing more occult, they can usually do the trick no longer, and this is precisely what we might expect. Similarly, if, instead of watching to see whether the person you are talking to is pleased or not, you watch for the facial changes which indicate

pleasure, you will not catch his emotional changes unless the symptoms are extremely gross. The conditions here are not greatly different from those obtaining in the visual perception of depth, where, if you attend to the signs, convergence, accommodation, binocular disparity, and so on, you will lose the depth-effect which those signs would give if they were not attended to.

The important question, therefore, is: What are the signs which tell us something about the mental characteristics of other persons? In the case of fleeting, ideational and emotional changes, these signs are obviously not anatomical; and in the case of fundamental tendencies of mental and moral sorts, we have already shown that there are no known anatomical signs. We are, therefore, forced to the conclusion that in the one case as in the other, the signs are physiological. Changes in the complicated muscular system of the face do occur along with ideas, especially if these ideas are emotionally toned. Changes in the complex musculature of the vocal organs and changes in the arm, leg and trunk muscles also occur. There are, in other words, changes in voice, in features, in posture and in other bodily postures and movements which are perfectly competent to serve as indexes of ideational and emotional changes. Unfortunately, we have not yet succeeded in analyzing more than the most gross of these signs.

Fundamental tendencies in ideational and emotional reaction give rise to habitual modes of expression of the various sorts. Habitual modes of expression, moreover, leave their traces, especially in the face, even when the actual expression is not occurring. There would seem to be, therefore, a complex system of signs, not only of fleeting mental changes, but signs also of character traits, provided we can make use of them.

Signs of this sort are effective, prior to analysis. Habits of perception and of judgment are built up on signs, without necessitating any analysis or identification of such signs. Moreover, the development of the capacity to catch meanings in this way, if it be possible, depends upon native capacity as well as upon practice. We should, therefore, expect to find exactly what we do find, namely, that there is great individual variation in this apparent skill, and that in the absence of a really comprehensive and accurate analysis of signs, the attempt to attend to signs is a disturbing factor.

Character analysts, if successful under real test conditions, obviously make their guesses just as you or I do. "The systems" can be nothing but obstacles, since they have no real bearing on the problem. But, after having made a guess, the analyst can readily find in his system details which back up his guess, provided the

system is elastic, depending upon sign patterns rather than upon hard and fast single signs. We need not assume that successful character analysts, if there are such, go through this sophistical process deliberately. The tendency to construe evidence to suit one's theory, and to recognize the data which may thus be construed, overlooking conflicting data, is too well known and too widespread to need demonstration. One of the important reasons why scientific procedure and scientific methods are necessary is that such procedure and methods are indispensable helps to the avoidance of arbitrary inferences, and even with the best of scientific aids the tendency will sometimes operate.

QUESTIONS

1. Report specific instances of belief and practices in magic or clairvoyance with which you are personally acquainted.
2. Why have so many people believed in physiognomy, phrenology, and fortune telling?
3. What facts are revealed in the study by Paterson and Ludgate on blond and brunette traits? What is found to be the only appreciable differences between blonds and brunettes? In what other traits might there be a difference?
4. Report instances of judgments in which one or more of the fallacies or ill-founded sources of belief in physiognomy appear.
5. Why is scientific procedure so necessary in evaluating methods of character analysis?
6. What is a stereotyped judgment of an individual? Describe an example. What does Rice's study of stereotypes indicate regarding the value of photographs in vocational selection?
7. What mental and social traits are revealed by size of physical features of the face? How reliable are these criteria?
8. Collect a half-dozen psychological "gold-bricks" from current popular magazines. Have you any suggestions as to why people are so susceptible to these appeals?
9. What is the relation between a prejudice and stereotype?
10. What is the mathematical technique required for the testing of uncritical assumptions about mind-body relations?
11. Point out fallacies of reasoning present in the Westerberg article. Why was the author unable to detect them himself?

CHAPTER IV

TECHNIQUE OF PERSONNEL SELECTION

In the preceding chapter our major concern was the demolishing of what we may categorically label wrong methods of interpreting human behavior. The detailed process of construction can now begin unhampered by ancient puerilities. Personnel administration or personnel management is a relatively new profession which draws most of its scientific substance from the different divisions of psychology. Of course it includes much more than just that; a well trained personnel manager will also have more than amateur status in economics, sociology, and industrial hygiene. He is essentially a specialist in the human relations of factory, store, or office.

Too often company officials have assigned a minor rôle to the personnel department, viewing it as an adjunct to the employment department or even identical with it. However justified this may be historically, it betokens a narrow conception of personal functions, which legitimately cover a much broader range in educating the employees, maintaining morale, adjusting disputes, promoting or transferring workers, etc. Many progressive plants assign to the personnel division the so-called "welfare" activities. These enterprises have been too often misinterpreted and sadly abused; rightly employed, they serve greatly to enrich the quality of human living in the unnatural environment of factory walls.

The authors represented in this section developed the techniques of scientific employment in very much the order in which they would be demanded in a life situation. The heart of the matter consists in obtaining *valid* and *reliable* measures of occupational fitness. Since these terms are so vital to sound scientific procedure, it will be profitable to pause and consider their meaning.

If a measure possesses *validity,* it actually does measure that which it purports to measure. A thermometer is a valid measure of temperature because it checks with facts known inde-

pendently. On the other hand, a photograph is in general a poor measure of an applicant's suitability, because it does not reveal essential qualities.

If a measure has high *reliability,* it consistently tells the same story about the thing measured. A balance scale is reliable if the weight of a given substance obtained by one chemist checks (within very narrow limits of error) with the weight reported by another chemist. Contrast this with the unreliability of the ordinary sales interview. In one experiment, a dozen sales managers rated fifty applicants for a real job; the amount of agreement among them was remarkably small. The man whom one manager placed first was actually placed last by another!

A. Basic Principles for Selection and Placement

1. *The Biological Concept of Man in His Work*

W. D. SCOTT, R. C. CLOTHIER and S. B. MATHEWSON, *Personnel Management*, rev. ed., 8, 9, 18 (McGraw-Hill, 1931)

Conception of Individual Differences.—This new doctrine went on to say that men cannot with justice and profit be regarded as all alike or handled all alike. It pronounced that men differ one from another as far as their mental qualities are concerned far more than they differ physically. No one had ever advocated clothing all the men of the country in shoes and clothes of the same size and shape and the fact began to dawn upon us that it was equally absurd to attempt to endow them with the same mental habiliments. It was recognized that one man may have unusual aptitude along certain lines and that another may lack it entirely; obviously it was out of order to attempt to cram them into the same job. It became apparent that one had the ability to learn in a degree entirely lacking in the other, that to try to develop them equally in the same way was similarly impracticable. It made itself clear that one man had distinct ambitions along one line, another along another, and that any stereotyped incentive would stimulate them unequally. The difference between men temperamentally forced itself upon the attention of these forward-looking employers and they saw that while one method of control, or discipline, would be effective with respect to one, another method would be required with respect to another.

Following the recognition that people differ from one another came the idea that the same person differs in various situations. The following facts concerning individual differences should be

kept clearly in mind throughout the study of Personnel Management:

First, one individual differs from another in those personal aptitudes, those special abilities with which he is equipped and which he is able to contribute to the work of his company in exchange for his salary.

Second, individuals differ in interest and motive and respond best to varying stimuli.

Third, the same individual changes from day to day and from year to year in ability (both in degree and kind) and in interest.

Fourth, different kinds of work require different kinds of personal ability in the persons who are to perform them.

Fifth, granting equal ability, different kinds of work are done best by persons who, temperamentally, are particularly interested in them.

Sixth, the work in each position in a company changes as time goes on; duties are added and taken away. Sometimes the change is negligible, sometimes it is great. In the measure in which it takes place, a similar change is apt to take place in the abilities and interests the work requires of the worker.

Seventh, environment—working conditions, supervision, relations with the employer and with fellow-employees, opportunity, and so forth—exercises a tremendous influence on personal efficiency and consequently on group production.

From this it is apparent that Personnel Management is not merely a problem of discovering the right man for the right place, the somewhat obsolete conception of square pegs for square holes, for the worker and his work will vary from time to time; consequently, the ability and interest of the worker will change and develop. Industry cannot merely bring two rigid inelastic units together which are so shaped that they will fit, for the worker and his job cannot be separated into units. Both are plastic and changing in themselves, the job exercising an influence on the worker and likewise the worker influencing the job.

Concept of the Worker-in-His-Work Unit.—We have said that the worker influences his job and the job likewise exercises an influence on the worker; we have also given seven essential facts of individual differences; we can now proceed to the conception and the elements of the worker-in-his-work unit as an entity by itself.

When a foreman is promoted and made superintendent, he is not the same when superintendent as he was when he was a foreman. He reacts differently to his new job and the job has a different effect on him; the old worker-in-his-work unit is destroyed and a new unit is created.

The task of management is to make every worker-in-his-work unit as effective as possible. To achieve this three different angles, or elements, of the worker-in-his-work unit must be given due consideration. Briefly they are as follows: first, Capacities, referring to those attainments, inherited or acquired, that a worker has, is capable of, and must, to a certain degree at least, exercise in his work; second, Interests, not only an individual's desires and ambitions, but also his instinctive, impulsive tendencies, vague yearnings, and ill-defined cravings which may or may not stir him to his fullest action in performing his duties; and third, Opportunities—not only Opportunities for advancement, although that is included, but Opportunities to exercise his Capacities and satisfy his Interests.

2. *Steps in Establishing Psychological Aids in Selection*

W. V. Bingham and Max Freyd, *Procedures in Employment Psychology*, 6-11 (McGraw-Hill, 1926)

Steps in Research Procedure.—1. After deciding upon the occupation for which an improved method of selection is to be devised, the first step is to make a job analysis to ascertain the precise duties and activities of the occupation, just what the worker does, what tools he uses, etc. The investigator will also want to know what the conditions of work are, the hours, the sources of applicants, the relation to other jobs in the organization, the opportunities for promotion, and the most frequent reasons for leaving.

2. The investigator should then in consultation with the responsible executives decide upon a criterion of success in the occupation. This is necessary in order to have some measure with which to compare the results of the experimental procedures in selection.

3. The next step is to choose persons to serve as subjects for the investigation. This choice will be determined in part by practical considerations and in part by the criterion of vocational success which has been agreed upon.

4. The investigator then proceeds to determine at least provisionally the abilities most essential for success. This step is facilitated by having for observation the workers who have been chosen as subjects for the investigation.

5. In the light of his analysis the investigator selects or devises psychological tests, questionnaires, rating scales, or other examinations which give promise of measuring these essential abilities.

6. Under carefully controlled conditions the investigator next applies these means of measuring abilities to the subjects chosen for the investigation.

7. At or before this stage of the research the reliability of the examinations should be determined. A test or rating scale which does not give the same results upon repeated trials is as unreliable for purposes of vocational selection as an elastic tape would be for measuring stature.

8. After the reliability of the examinations has been ascertained, their validity as indicators of success in the vocation is determined. The investigator validates a measuring instrument by comparing his measurements with the criterion of vocational success. A device is valid and useful which yields measures so closely related statistically to the criterion of success that, knowing a person's score, his degree of success in the occupation may be at least roughly foretold. The value of the examination depends upon the closeness with which it predicts the vocational success of the applicant.

9. The next step in the research is to find what combination of the several examinations which have proved to be valid, yields a total score with a maximum predictive value.

10. The investigator will then have to justify this battery of tests or other aids in selection by comparing its predictive accuracy with that of the methods of selection previously in use.

11. If the new methods prove to be more efficient and are recommended for adoption, he installs them as a part of the employment procedure. He also assures himself from time to time that they are being used properly, and checks their predictive accuracy frequently in order to adjust them if necessary to changes in industrial demands or type of applicant. . . .

Choice of Job or Occupation to be Studied.—Not every occupation can profitably be made a subject of scientific study. . . . Before deciding on an investigation of selection methods in an occupation, there is need of answers to these five questions:

1. *Does a problem of selection actually exist in this occupation?* Every scientific investigation aims to solve a problem. It may happen that the problem here defines itself concretely in the form of excessive labor turnover, low production, or costly breakage in one department. If no such definite and limited problem has been made obvious, but if the management wishes to raise the general level of efficiency in its employment department, then the investigator will find it advisable before he proceeds with his investigation to ask the cost department to help him find the job where increased efficiency in selecting employees would bring about the greatest economic saving. . . .

2. *Are there more applicants than jobs?* If the number of available applicants is less than the number of jobs that must be

filled, then a research in selection is beside the point. Exceptions to this rule are found in those instances where greatly improved selection has decreased the number of employees required to do the work or has attracted to the employment window a larger and better group of applicants.

3. *Are there enough employees doing the same kind of work to make possible a reliable study?* Statistical method demands a considerable number of cases for exactness of conclusions. If only a few employees are doing the same sort of work, the findings of an investigation will have only a very low reliability when used to select from among future applicants.

4. *Is there a valid and reliable criterion of success at this work?* Without some dependable indication of a man's actual success, it will be impossible to find out whether or not the proposed measurements of abilities distinguish between successful and unsuccessful employees.

5. *Is the investigator assured of coöperation?* A reliable study is a practical impossibility without coöperation of both workers and management.

B. Job Analysis and Job Specification

Vocational selection and placement by an employing agent in a central employment office depends upon a knowledge of the jobs to be filled. Personal experience and familiarity with the jobs is very valuable, but no individual can know the details of all activities in a large organization. Written descriptions of the activities and requirements of each job will aid him. A carefully worked out job description is commonly called a *job analysis.* When this is written or translated into terms of the qualifications of a person desired to fill the job, it is often called a *job specification,* occupational specification, or man specification. Job analyses not only aid in selection and placement of men in jobs, but they also are valuable aids in directing training for specific work and in making wage adjustments and organizing lines of promotion.

3. *Procedure in Job Analysis*

F. J. Meine, "Job Analysis for Employment Purposes," *Annals of the American Academy of Political and Social Science,* 110: 26-27 (1923)

What is the procedure for making an analysis which leads to job specifications? How do we go about making such an analysis?

Many instructions have been given on how to analyze jobs, but some of the best of these suggestions have been outlined in a report of the Committee on Descriptions of Occupations of the Industrial Relations Association (1920).

The following suggestions are aimed to help the analyst in his work:

1. Where to begin. Begin with one department in your factory which is best known to you and where you are sure of the coöperation of the department head, foreman and other employes you may wish to consult.

2. Coöperation. Get together with the foremen and sell them the idea of the job specification. Point out the value to them (*a*) in having the employment department secure full knowledge of the requirements of every job in their department; (*b*) in furnishing data upon which to base fair wage scales which pay like amounts for jobs making similar demands.

3. Preliminary classification. Group roughly and classify all jobs in the department.

(*a*) List all jobs for which somebody is usually hired.

(*b*) Decide upon a distinct name for each job. Adopt, whenever clear, names commonly used.

(*c*) Group together jobs identical or very similar, especially those performed by the same type of employe, or those performed by the same employe on a job consisting of several smaller jobs of similar nature.

(*d*) Group together jobs of the same general occupational nature, as assembling jobs, machine operating jobs, maintenance jobs, etc., keeping each job distinct. This will facilitate analysis as certain factors will affect all jobs of the same general type.

When it is the intention to use the classification of jobs as a basis for fair wage schedules, further classification is usually necessary. This may be done either before the detailed analysis or after it, depending upon the type of industry and the knowledge already available about the jobs. If done before, it is really a sort of preliminary job analysis for the purpose of classification (i.e., grading); if done afterward, it may be accomplished by sorting the job specifications into groups according to the classifications (grades) decided upon. Before the detailed analysis is made it may be advisable to formulate the general scheme of classification to insure getting all the necessary information.

4. Outline main points. Draw up a definite outline or a standard set of points to cover all jobs.

5. Sources of information. Observation. Study the job to be

written up. Notice what is done and how it is done, the type of employe doing the job, working conditions, and any other factors in the outline. Write up all you know about the job or have learned from your own observation.

6. Foremen and workers. Get your foreman to give you as complete a statement as possible on all the points to be covered. Be sure to evaluate his statements and discriminate between facts and opinion. Talk with assistant foremen and, if time permits, talk with a few of the workers about the job. Whenever possible have some of the workers analyze their own jobs and make specifications for them.

7. Staff specialists. Consult the various specialists in the plant so as to get the requirements of the job from their particular angle and viewpoint. Consult the mechanical department on questions of equipment; the rate-setting or methods department for the detailed processes and operations involved, for motions and fatigue, and for standard practices established; the safety man as to hazards of the job; the medical department as to health and physical requirements.

8. Compare results. Study over these analyses made by foremen and compare them with your own estimate of the job and its requirements. Check at all times by observation of actual conditions.

9. Job specification. Then draw up a job specification which states the facts clearly and completely.

10. Submit the tentative job specification to the foreman for criticism and suggestions, and make any revisions necessary. When finally agreed upon by the foreman and employment department submit to the head of the department or division for final approval.

These "instructions" are intended to serve merely as a guide to the essential steps in the job analysis procedure. The technique for making this kind of job analysis is not finally fixed: it seeks sources of better methods and more refined technique as these instruments become available, and seeks to use these better practises when such refinements are profitable. One such source of aid to the job analyst in bettering his procedure is psychology with its point of view, methods and technique for dealing with concrete human problems, especially with such problems as arise in connection with the determination of human requirements for particular kinds of work.

4. *Comprehensive List of Items in a Job Analysis*

W. V. BINGHAM and M. FREYD, *Procedures in Employment Psychology*, 15-17 (McGraw-Hill, 1926)

1. Identification of the job
   Name of the occupation. Identifying symbol. Alternative names. Names and locations of departments in which the work is carried on. Similar occupations from which or to which workers could be transferred.
2. Number employed
   Present force. Anticipated requirements.
3. Type of work
   Statement of the duties, functions, and responsibilities connected with the job. This should be a broad identifying statement, and should not cover the method of carrying out these duties nor the abilities required.
4. Technical equipment
   Tools. What kind of tools? Who supplies them? Who is responsible for their upkeep?
   Machines. What type? In what condition? Who is responsible for upkeep?
   Materials. What kind? What variations? Description of materials.
5. Exact operations
   The exact duties and the ways in which they are carried out. This should be in narrative form and in great detail. Operations should be listed numerically in sequence. *Begin each item with an active verb.* Give the amount of time devoted to each operation and its relative importance. Describe the exact motions in form that may be suggestive of test construction. What parts of the body are used? Are movements standardized? What repairs or adjustments to the machines or equipment does the worker have to make?
6. Conditions of work
   Location. Factory, office, inside, outside, overhead, underground.
   Workroom. Ventilation, temperature, humidity, illumination.
   Time. Permanent, temporary, day, night, hours of labor per day, hours per week, overtime, peak loads, uniformity of work, rest pauses, lunch hour, vacations.
   Posture. Standing, sitting, stooping, walking, climbing, reaching, lifting, kneeling.
   Speed. Quick, moderate, slow, variations in speed. Necessity for turning out work extremely fast to meet an emergency.

Accuracy. Coarse, fine, exacting. Possibility of loss through inaccuracy.
Automaticity. Varied, routine, monotonous, mixed.
Health hazards. Nerve strain, eye strain, physical strain (heavy, medium, light), moisture, heat, dust, fumes, acids, exposure to weather.
Accident hazards. Slippery floors, unguarded machinery, pointed tools, rapidly moving objects, liability to burns.
Disagreeable features. Dirt, noise, oil, and others included above. Vibration. Fatigue. What are the most frequent or serious grievances?
Agreeable features. Cleanliness, prestige, companionship.
Social features. Does the employee work alone or with others? Is he permitted to talk? How close is the supervision over him?
Standards of output. What standards must be met? How are quotas set? Is inspection uniform and equitable?

7. Pay
Method. Monthly, weekly, biweekly, daily, hourly, piece-rate, guaranteed hourly minimum plus bonus, check or cash.
Rate. Average earnings, range of pay, starting pay, maximum obtainable. How often are advances in pay given?
Bonuses and premiums. When given? How much? On what basis?
Penalties. For absence, tardiness, infringement of rules, spoilage.

8. Non-financial incentives and rewards
Social rewards for good work. Incentives to speed and high quality of output. Prestige connected with the job.

9. Training
Is training given by the company? In vestibule school or on the job? What does it cover? How long does it last? How much does it cost to train a worker? What percentage of new workers complete the training? How is the worker paid during training?

10. Broader social aspects of the job
What are the ambitions and ideals of the workers? What are their standards of success? What employee service does the company make available? Hospital, insurance, sick benefits, pensions, loans, employee stock ownership, employee representation in management, social work, night classes, recreation, house organ, housing. What is the psychological effect of the job on the worker? What sort of home life do the workers have? What are their living conditions in general outside of

the factory? Fatigue, recreation, temperance, marriage. Social status of fellow workers.

11. Relation to other jobs
    Organization charts, showing lines of promotion, lines of authority, lines of routine procedure. Comparison with other jobs in regard to salary, opportunity for promotion, prestige, and so forth. Is the acquired skill an asset outside of the company?
12. Employment conditions
    Selection. How are workers selected? How efficient is this method? What other methods have been used? What would improved methods of selection accomplish? Sources of supply. Unions.
    Promotion and transfer. What opportunities for either? Adequate personnel records? Periodic rating and consideration for promotion or wage readjustment?
    Turnover. What is the turnover? What are the most frequent causes of leaving?
13. Records
    What records of output, rate of progress, quality, spoilage, materials, time, and so forth, are available? Application blanks, references, ratings, and so forth.
14. Problems
    What are the main personnel problems which this job has raised?

5. *Trade Specification*

The trade specification differs from the job specification as the titles indicate. The trade specification usually covers a wider range of activities, and is stated in more general terms. It may include several specific jobs. An example taken from the army trade specifications is reproduced below:

J. J. SWAN, *Trade Specifications and Occupational Index,* Document No. 774:60 (Office of the Adjutant General, War Department, Washington, D. C., 1918)

Boilermaker, Expert

Duties

1. Laying out and supervising construction, erection, rebuilding or extensive general repairs to various forms of water tube, fire tube and locomotive fire-box boilers, for stationary, portable or marine service.

Qualifications

2. Must be thoroughly experienced in all practical phases of standard boiler construction, and familiar with standard A.S.M.E. Boiler Code, able to work to drawings and sketches, and make necessary calculations for general and detail layout.

   Must also be able to accurately lay out templates for shell plates, heads, crown sheets, angles, braces, tubes, manholes, dome and headers, and understand boiler assembly.

   Must thoroughly understand the processes of shearing, heating, straightening, bending, flanging, scaring, punching, drilling, reaming, chipping, caulking, and riveting with either hand or pneumatic tools and "squeezer."

   Must be skilled in tube fitting, setting and beading, re-welding and replacement on all classes of boilers.

   Must be practically familiar with shears, single and gang punchers, bending rolls, flanging presses, boiler shop furnaces and general boiler makers' equipment and tools, including pneumatic drills and hammer, and electric drills.

   Must be able to test new or operating boilers, make quick surveys for repairs, and be thoroughly familiar with straightening buckled plates and be able to patch and make any sort of boiler repairs.

   Should understand use of autogeneous welding equipments and should also have had wide general experience on boiler and pressure tank construction in large boiler-manufacturing plant.

Substitute Occupations

3. Foreman boiler maker, general boiler maker, boiler maker.

6. *Requirements of a Typical Job*

W. W. Charters and I. B. Whitley, *Analysis of Secretarial Traits and Duties*, 173-175 (Williams & Wilkins, 1924)

The Problem.—The problem was to determine the traits which are conspicuously possessed by successful secretaries and are conspicuously absent in unsuccessful secretaries, and to determine the relative importance of those traits.

The Method of Attack.—Procedure comprised four steps: (1) interviewing men prominent in their respective vocations, who would naturally be expected to have superior secretaries, to discover what traits they considered to be important; (2) translating what those interviewed had said into the terms of abstract traits; (3) defining those traits in terms of trait-actions; and (4) obtaining

EXHIBIT M

Vocational Traits for Secretaries (Frequency Ranking)

Trait	Number	Rank
Accuracy	24	1
Responsibleness	23	2
Dependability	21	3
Intelligence	21	3
Courtesy	20	5
Initiative	20	5
Judgment	20	5
Tact	19	8
Personal pleasantness	18	9
Personal appearance	18	9
Interest in Work	17	11
Speed	17	11
Reticence	16	13
Adaptability	15	14
Businesslikeness	15	14
Neatness	15	14
Memory	14	17
Good breeding	13	18
Poise	11	19
Self-confidence	11	19
Graciousness	10	21
Honesty	10	21
Health	10	21
Industriousness	10	21
Executive ability	9	25
Loyalty	9	25
Pleasant voice	9	25
Orderliness	8	28
Grooming	8	28
Alertness	7	30
Drive	7	30
Ambition	6	32
Curiosity	6	32
Forcefulness	6	32
Foresight	6	32
Thoughtfulness	6	32
Thoroughness	5	37
Willingness	5	37
Modesty (not conceit)	4	39
Originality	4	39
Patience	3	41
Resourcefulness	3	41
Self-control	2	43
Versatility	2	43
Fairness	1	45
Self-respect	1	45
Sense of humor	1	45

a composite picture of the employers' judgments by ranking the traits according to the frequency of their mention.

Exhibit M presents the frequency ranking thus obtained. The total number of mentions, as well as rank in list is given. The qualities that are most significant are those that come at the top of the list because they are, in the minds of most of the men interviewed, most significant in relation to the success or non-success of a secretary. Accuracy, responsibleness, and dependability are very important and are followed closely by intelligence and courtesy, while on the other hand, sense of humor, patience, and lack of conceit, while of importance, are still not outstanding traits of the secretary.

It will be noted also that contrary to popular opinion, attractive personal appearance is not a quality which is of conspicuous importance, nor is speed so important as accuracy, industriousness so important as initiative, and so on.

7. *Criteria of Vocational Success*

W. V. Bingham and Max Freyd, *Procedures in Employment Psychology*, 30-42 (McGraw-Hill, 1926)

A criterion of accomplishment is something which may be used as a measuring stick for gauging a worker's relative success or failure.

Such a measure of the worth of an employee to his concern should consist of more than the mere opinion of his supervisors. A good criterion of success is objective, factual, reliable. It answers with definiteness such questions as these: Who are the most valuable workers, and who the least valuable in a selected department? What is the order of merit within a list of salesmen? Which of the executives are outstanding successes and which could most readily be spread?

Unless the records of factory or office yield dependable answers to such questions, it is impossible to determine quantitatively the results of improved procedures of selecting and developing personnel; but where adequate measures of occupational success are to be had, the way is open for the trial of scientific personnel methods and the determination of their validity. An executive can, for example, check one method of hiring with another, and learn definitely which pays best. He can find the answers to questions as to which of two methods of supervision, or of remuneration, is most effective. He has a measuring stick which is indispensable in quantitative studies of many vital personnel problems.

From the management's point of view, the successful employee,

in contrast to the unsuccessful, does more work, does it better, with less supervision, with less interruption through absence from the job. He makes fewer mistakes and has fewer accidents. He offers a large number of good original suggestions looking toward improvement of conditions or of processes. He ordinarily learns more quickly, is promoted more rapidly, and stays with the company. His quantity and quality of output, rate of advancement, length of service, and so forth, are aspects of vocational success, each of which can be measured, expressed in numerical terms, and used as a criterion against which to check the validity of predictions based upon employment tests, personal history items, interest questionnaires, or interviews.

Dependable measures of actual accomplishment, of success or failure at the job, are needed for any scientific investigation in selection of personnel. Many a study of methods of selecting people for positions has led to ambiguous conclusions because of the inadequacy or unreliability of the criterion by which the methods were judged. All too often a research has passed through the laborious and expensive stages of making the job analysis, constructing ingenious tests, and giving the tests to numerous employees, before the investigator discovered that no adequate and reliable measure of relative individual achievement on the job was to be had. The salesmen for a corporation doing a business of national scope were given a battery of tests at a series of sales conventions with the thought that the value of the tests would then be ascertained by checking the scores against the auditor's records of commissions earned. Later it was found that commissions were not a fair criterion of sales ability in that concern because of gross differences of territory and inadequate bases for quota setting. Ratings of the value of the salesmen to the company, made by the branch sales-managers and the home-office executives, did not agree. No other criterion of success was available except length of service with the concern, and that measure was not considered a good one by the interested executives. The investigation had then to be abandoned for lack of a sound criterion.

Early consideration, then, of available criteria of vocational success in the occupation being studied will enable an investigator to avoid serious pitfalls. The selection of subjects for the investigation, the determination of the abilities essential to success in the vocation, and the choice of tests will depend in part on the criterion of success which is adopted.

If there were no problem of personnel there would be no need to make an investigation of the type we are describing. The motive for making the investigation usually comes from a large turnover

among workmen, excessive breakage, low output, high cost of training new employees or some similar problem of management. When the investigator is faced with such a problem, the criterion by which the management will judge his efforts is the improvement of existing conditions. The investigator is obliged to adopt as his criterion the variable which has occasioned the study. . . .

Suggested Criteria of Success.—Mention will be made of 13 kinds of criteria of vocational accomplishment by which psychological tests and other measurements of ability may be evaluated. If more than one reliable criterion may be had, it is important that the measurements be checked against each of them separately. Wechsler, for example, in his study of taxicab drivers, discovered that one of his tests predicted the number of accidents the driver would have and another the wages he would earn. The use of only one of these criteria would have made his study half as valuable.

1. Time required to train the employee. . . .
2. Standing in corporation schools. . . .
3. Quantity and quality of output. In spite of the precautions their use requires, measures of quantity and quality of output are on the whole the most useful criteria. . . .
4. Performance in standardized examinations. Often it will be found that usable measures of quantity and quality of output of individual workers are not to be had. The investigator may save time in the long run by pausing to devise and standardize performance examinations—typical sample jobs by means of which he can determine how ably the workers can do their work. . . .
5. Accidents and loss due to breakage or claims. . . .
6. Salary. . . .
7. Commissions and bonuses. . . .
8. Length of service or stability on the job. . . .
9. Advancement in the firm. . . .
10. Degree of responsibility. . . .
11. Membership in professional societies. . . .
12. Trade status. If a classification of workers into levels of skill is recognized by the unions or by the management, these gradations of trade status may be used as a criterion. . . .
13. Ratings. Ratings may be made by immediate superiors, by teachers in corporation schools, or by fellow workmen. Because ratings are less objective and reliable than most of the preceding measures of success, they should not be used if these others are to be obtained.

C. Applications and Records as Aids in Selection

8. *Applications on File*

L. K. FRANKEL and A. FLEISHER, *The Human Factor in Industry*, 29 (The Macmillan Co., 1920)

Application Blanks.—The need for additional workers should be forestalled as far as possible by the use of application blanks, filed and classified for future reference. Not only should all applicants coming to the plant fill out application blanks to go on file, but such blanks should be filled out by those reached through other channels as well. Those who send letters of application should be asked to come to the plant to fill out the regular blank, or when this is impossible, blanks can be sent to them. The development of such a file will make it possible to (*a*) keep a selected list of good material for future reference; (*b*) attract a superior class of men who are not out of work but are looking for better opportunities and can wait for an opening; (*c*) postpone the engagement in order to dispel the first impression made by the applicant; (*d*) eliminate floaters.

9. *Letters of Application*

A. T. POFFENBERGER and V. H. VARTANIAN, "The Letter of Application in Vocational Selection," *Journal of Applied Psychology*, 6:76-80 (1922)

Twenty-five students in the senior class of a training school for religious workers in New York City wrote letters of application for a position as religious worker. These letters just as received were given in turn to twelve members of the staff of the Union Theological Seminary, New York City, with the request that they arrange them in an order according to the degree to which they indicated general fitness for the position.

The measures which were to serve as checks against the letters were obtained as follows: Five teachers from the staff of the training school furnished three separate arrangements of twenty-five individuals according to the degree to which they possessed the three traits, general ability, intelligence and tact. These three traits were thought by the teachers to cover the qualities most needed for success in the religious work. In addition each member of the group of applicants arranged his twenty-four associates and himself in an order for each of these three traits. . . .

We have then for purposes of comparison the following material:

(*a*) Estimates of general fitness determined from the letters
(*b*) Estimates of general ability by the teachers

(*c*) Estimates of intelligence by the teachers
(*d*) Estimates of tact by the teachers
(*e*) Estimates of general ability by the associates
(*f*) Estimates of intelligence by the associates
(*g*) Estimates of tact by the associates

1. *Correlation between Traits.*—When the individuals are judged directly by the teachers and associates, the traits are found to be related as follows:

General ability and intelligence	.95
General ability and tact	.82
Intelligence and tact	.86

These coefficients indicate the tendency to judge from general impression. It would seem that, for practical purposes, a judgment for general fitness would be better than judgments for special traits, as such a task would be much less likely to confuse the judges.

2. *Relation between the Estimates of Teachers and Associates.*—The following coefficients show the relation between the average arrangement of the twenty-five individuals by the teachers and by the associates for the three traits:

General ability	.90
Intelligence	.83
Tact	.59

The coefficients for general ability and intelligence are rather high, while that for tact is very much lower. This is, doubtless, due to the fact that the associates and teachers have different criteria of tact. There are no objective measures of this trait to form a common basis for judgment such as school grades would afford for intelligence or general ability. . . .

4. *Relation between Estimates of Letters for General Fitness and Direct Estimates of the Individuals.*—The following figures show the correlations between the estimates of the letters and the estimates of the individuals for the three traits, general ability, intelligence, and tact by teachers and associates.

General ability (combined estimates of teachers and associates) and letters	.50
General ability (teachers' estimates) and letters	.56
General ability (associates' estimates) and letters	.46
Intelligence (combined estimates of teachers and associates) and letters	.44
Intelligence (teachers' estimates) and letters	.58

Intelligence (associates' estimates) and letters	**.44**
Tact (combined estimates of teachers and associates) and letters	**.22**
Tact (teachers' estimates) and letters	**.20**
Tact (associates' estimates) and letters	**.18**
General ability, intelligence and tact (combined estimates of teachers and associates) and letters	**.45**
General ability and intelligence (combined estimates of teachers and associates) and letters	**.48**
General ability and intelligence (teachers' estimates) and letters	**.55**
General ability and intelligence (associates' estimates) and letters	**.49**

5. *Relation between Individual and Group Judgment.*—The coefficients of correlation of individual arrangements of the letters with the average order for general ability obtained from the associates are as follows in order of size: .18, .24, .26, .34, .34, .40, .40, .40, .46, .46, .48, .52. The average of these coefficients is .37. Now the coefficient of correlation of the *average order* for the letters (group judgment) with the average order of the individuals judged by their associates for general ability is .46. Thus the group judgment is somewhat better than the average of the individual judgments. Only two of the individuals show a higher correlation than that of the group. Therefore, although one might find a judge who would do better than the group judgment, the group judgment would be safer unless one had some means of knowing the good judges beforehand. . . .

Conclusion.—Individual differences in the ability to judge fitness from letters of application must be recognized. Some traits are much more clearly indicated in letters than others, while certain traits like tact can probably not be measured in letters. The combined estimates of a group of judges is more to be relied on than the judgment of one individual unless there is some means of picking the good judge. Some of the correlations here reported are as high as has been expected from the use of intelligence and other more specialized tests as measures of fitness for practical purposes.

The letter of application is not to be relied on even for a preliminary weeding out of candidates unless the ordinary safeguards against personal bias, etc., be used. But if treated and controlled as a test method it should be of service in vocational selection. It might be made to give a composite picture of neatness, intelligence, schooling, truthfulness, interest in details, ambition and many other of the character traits for which at present there are no adequate measures.

10. *The Application Blank*

DOROTHY B. GOLDSMITH, "The Use of the Personal History Blank as a Salesmanship Test," *Journal of Applied Psychology*, 6:149-154 (1922); modified

This study was made to determine whether the items of a personal history blank could be used to predict the success or failure of a salesman. That is, whether a weighted, quantitative score could be given to the answers to questions upon a history blank, in order that it might be used as an elimination test. To accomplish this, the scoring of the blank had to perform two functions—(1) it must eliminate failures, and (2) it must *not* eliminate successes. The chief purpose was, therefore, the establishment of a critical score, a score below which would fall the failures and above which would lie the successes.

To secure a proper scoring method for the blanks, a tentative plan based on a previous study was tried on fifty blanks. These fifty blanks were selected at random from the total of 502 blanks used in the complete study, but they were chosen so as to represent three classes of agents.

These classes were (1) those who were failures, (2) those who were borderline cases up to moderately successful, and (3) those who were successful. The criterion of success was the amount of insurance paid for during the first year after the man was licensed. (We had already found out that the first year's production was a very good index of future production.) It would be well here to mention that the only factor which determined the selection of the 502 blanks was whether or not the agent's first year's production record was available. The blanks for these three classes of men were then studied and the essential or significant items which varied with the success of the agent were selected. Each blank was then graded according to the tentative scoring, and the total thus obtained was checked against the man's production record. In accordance with these results, the scoring was revised, and the same process repeated with 25 blanks selected at random. We found that those whose scores on the blank were low were also low in production, and that with increasing production the scores tended to be higher. The correlation, of course, was not a perfect one, but we were interested rather in establishing the lower critical score than in correlations. Inasmuch as the personal history blanks selected at random were well distributed into our three classes by the scoring which we had determined upon, we selected this scoring as our final method. The weighted values thus assigned to the significant items were as follows:

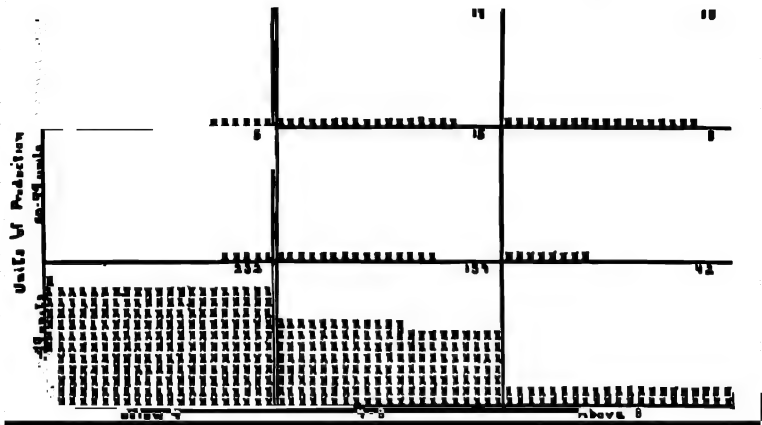
Age	*Weight*
18 to 20	—2
21 to 22	—1
23 to 24	0
25 to 27	+1
28 to 29	+2
30 to 40	+3
41 to 50	+1
51 to 60	0
Over 60	—1
Marital Status	
Married	+1
Single	—1
Clubs	
Belongs to clubs	+1
Does not belong	—1
Education	
8 years	+1
10 years	+2
12 years	+3
16 years	+2

Occupation	*Weight*
Social	+1
Non-social	—1
Insurance	
Carried	+1
Not carried	—1
Service	
Full time	+2
Part time	—2
Experience	
Previous life insurance experience	+1
Confidence	
Replies to question: "What Amount of Insurance Are You Confident of Placing Each Month?"	+1
Does not reply	—1

All of these significant items are the results of study of the personal history blanks. They do not represent guesses as to what ought to distinguish successful from unsuccessful agents, but items upon which successful and unsuccessful men actually have differed. Of course, in no single case will all these items be significant, various factors will operate in some instances to cause certain items to lose their predictive value for certain men. It is not upon any single item, however, that we will base our conclusions, but rather upon the total result from all the items.

After the total score for each of the 502 personal history blanks had been made up, the first year's production record for each agent was secured. The blanks were then divided into three groups, (1) those who made a score below 4, (2) those who scored between 4 and 8, and (3) those who scored above 8. The lowest score actually made was —5 and the highest, 14. Each class was then divided into three parts, those whose production was below 50 units, those with a production between 50 and 100 units, and finally, those who were over 100 units. The number falling into each class was computed. On the ordinates of the following chart have been plotted the production units, and on the abscissa, the scores on the personal history blanks. The double line marks the critical score placed at 4.

There are 243 men who fall below 4 on the personal history blank, that is, 243 men who lie below the critical score indicated by

the double line. Of the 243, 232 also fall below the minimum satisfactory production which has been placed at 50 units. Thus, of men scoring below 4, 96 per cent are failures in production.

RELATION OF PERSONAL HISTORY SCORE TO PRODUCTION RECORD

The cases to the right of the second vertical are agents who scored 8 or over on their blanks. Of these 68 men, 36 had a production of 50-100 units or over 100 units, and so may be termed moderately to very successful. Therefore, of men scoring above 8 on the history blank, 53 per cent are successful, as opposed to 4 per cent of successes among those scoring below 4.

In between the first and second verticals are the men who made between 4 and 8 on their blanks. The results here are not as striking as in the other groups. In this division, although 83 per cent are failures, 17 per cent are successes. Should other tests be given, they would probably serve to differentiate further among the agents forming this group.

Looking at the chart the other way, we find that of the 433 agents whose production was less than 50 units, or in other words, of those below the first or lower horizontal, 54 per cent fall into the group whose score on the personal history blanks is below 4. That is, this group of agents scoring below 4, the critical score, contains more failures in production than do the other two groups of those above 4 put together. If, on the other hand, we turn to the group which we may term moderately to very successful, we find that of the 68 agents composing this group whose production is over 50 units, only 11, or 16 per cent, will be found among those in the group scoring below 4 on the personal history blank.

It is evident that the critical score should be set at 4. By cutting out those falling below that figure, we eliminate 54 per cent of the subsequent failures, while 84 per cent of the subsequent successes remain with the company. If the critical score were set higher up at 5 or 6, it is true that more failures would be eliminated, but at the same time more successes would be cut off—an unprofitable operation.

The study of these 502 blanks has, therefore, indicated that for a life insurance company, the score on the personal history blank bears a positive relationship to the applicant's future success, and that on this blank a lower critical score may be set, below which it would not be worth while to license an applicant. The same would probably hold true for other sales forces in other occupations, but insofar as each industry presents a different problem, a different method of scoring would have to be worked out in each case.

11. *Evaluation of Items in Personal History Records*

GRACE E. MANSON, "What Can the Application Blank Tell?" *Journal of Personnel Research*, 4:74-75 (1925); reprinted by permission of Williams & Wilkins Co.

The present investigation includes data from 4,178 agents of eighteen life insurance companies of varying size, doing business in widely scattered sections of the country. The problem thus became that of determining the personal history qualifications necessary for selling life insurance for any company rather than the qualifications necessary for a specific company. We have assumed that a man having the qualifications necessary for the vocation will be successful in any company, provided that conditions within the company or within the agency are normal.

The results of this study show that there is not a very close relationship between any one of the biographical items found on the Agent Experience Record and subsequent success in selling life insurance. Those items which bear the closest relationship are: amount of insurance carried at contract, number of present club affiliations, and number of years of experience in selling life insurance. The two latter items are dependent upon information which is not available at the time the applicant is applying for a contract. The two specific items which have the most reliable predictive value are: (*a*) it is favorable to have three or more dependents at time of contract; and (*b*) it is favorable to carry $15,000 or more life insurance at time of contract. If the standard requirement for reliability is lessened so that differences are considered reliable if the difference equals twice the standard error of the difference,

then it is favorable, (*c*) to be between the ages of 36 and 39 inclusive, at time of contract, (*d*) to have had 2, 3 or 4 previous jobs, and (*e*) to carry $5,000 or more life insurance at time of contract.

When several personal history items are considered, and each of these is given a proper weighting, the multiple coefficients of correlation with success in selling range around 0.40.

When the personal history records of a group of agents having approximately the same length of experience with their companies, are scored by several methods, the coefficients of correlation between the total score and production range from 0.15 and 0.41.

These correlations show that the information contained on the personal history record has some predictive value, but that its accuracy in prediction is not sufficiently reliable to justify its use as the principal measure of future success in selling life insurance. On the other hand, multiple correlations ranging around 0.40 do indicate that the weighted personal history record has sufficient prognostic value to warrant its inclusion in all selection programs.

12. *The Use of Reference Letters*

A. W. Kornhauser, "A Study of Four Reference Report Forms," *The Personnel Journal*, 6:39-40 (1927)

We need to apply, as far as is feasible, the same scientific technique used in the study of tests, to the analysis and evaluation of personal history information, reference reports, interviews, rating scales, and like procedures. These qualitative and subjective methods may furnish real aid in the size-up of the individual, even though they prove less useful than tests. It is not a matter of one or the other, but of the best practicable combination of available tools.

The present report summarizes the results of a little investigation of the kind just suggested. . . . Four different forms were tried out and compared in terms of their results. They were sent to a representative sampling of all the reference names given by 122 students.

The Reference Report Forms.—The forms may be briefly described as follows:

Form A calls for reports of seven character traits on a graphic rating scale; space for remarks is added. . . .

Form B contains a brief paragraph asking for "your estimate of this student" and stating that "specific information concerning personal characteristics and abilities will be especially helpful"; a blank page follows. . . .

Form C is similar to Form B but has a much longer intro-

ductory statement with mention of the kinds of information desired. Thus, "The University desires particularly to know whether or not the student has acquired an interest or interests of an intellectual nature; . . . whether or not he has acquired capacity for study independent of the constant guidance and stimulus of the teachers." Illustrations follow, including dramatic work, independent reading in history, performance of experiments of his own, etc. . . .

Form D asks for a rating of intellectual interest as revealed in school work, and for specific evidence on which the rating is based. A second part calls for similar rating and evidence with respect to intellectual pursuits other than required school work. Space for additional comment is added. . . .

Conclusions.—The main conclusions that can be drawn from our inquiry concerning reference reports are as follows: (1) The reference reports are of demonstrated value as aids in estimating students' qualities. (2) They are distinctly less valuable in predicting scholastic ability and intelligence than are tests and high school records. They are more helpful, however, in estimating such qualities as industry and initiative. (3) The value of the reference reports was found to vary considerably depending on the form employed. This fact suggests the possibility that much more favorable results may be obtained in this direction through improved technique. (4) The four forms which were studied were compared in several ways—by percentage returns; by correlations with criteria of the number of references per student, returns per student, ratings included on the reference blanks, estimates based on the reference forms alone and on these forms in combination with other information about the students, and finally by judgments of several judges as to which forms seemed to contain most helpful material. These methods of evaluation as a whole showed the rating scale form (Form A) was definitely better among friends and previous employers than was an ordinary form (Form B) in which a brief paragraph asked for opinions and information. Among teachers the rating scale form was also superior to a more traditional form (Form C) while the other form tried (Form D) gave still better results.

13. *Kinds of Recommendations*

H. E. Burtt, *Principles of Employment Psychology*, 412-413 (Houghton Mifflin, 1926)

There are three general kinds of recommendations. The first is the testimonial which the applicant solicits and takes with him

when leaving an employer. This type of testimonial is usually a brief statement of satisfactory service. It cannot go into much detail nor give anything of a confidential character because the applicant sees the letter himself. A second type of recommendation consists of a letter written directly to the prospective employer at the request of the applicant. This is somewhat better than the former type because it involves confidential material; the previous employer can write with little restraint, and if he cares to do so can give an unbiased account of the individual's qualifications as far as he can judge them. The third type of recommendation consists of a letter in response to an inquiry from a prospective employer to some previous employer. This has the great advantage of calling for, and probably obtaining, the specific information that is wanted. Whereas in the other cases the prospective employer may receive a lot of high-sounding irrelevant material, in this case he obtains information primarily on the points which he considers significant in his particular situation.

The last of these types of recommendation is the only one that is worth serious scientific consideration. The conventional method is to write a simple personal letter of inquiry, but there is the possibility of some refinements in this method. It is feasible, for instance, to construct the inquiry in such a way as to save a lot of time on the part of the one answering it as well as on that of the one who is subsequently to evaluate it. While it is possible to ask specific questions requiring a more or less detailed answer, a cue may be taken from the general technique of mental tests. Instead of using questions requiring sentences for an answer, one may obtain the same information by having the writer merely indicate his answer by a few check marks, or at the most by a few words. In mental tests, for instance, instead of asking the subject to write the opposite of the words, we present several alternatives and he checks the correct one. Exactly the same procedure may frequently be adapted to the recommendation blank. The following blank is typical.

DEAR SIR:

Mr.———has applied to us for a position as———and has named you as a former employer. It will help us if, in entire confidence, you will give us the information requested below. We shall be glad to reciprocate at any time.

1. In your opinion is he honest and responsible? Yes.... No.....
2. Is he temperate with tobacco and alcohol? Yes.... No.....
3. Does he possess skill in the work named above?
   High skill.... Generally qualified.... Doubtful.... No skill....

4. He states that he was in your employ as............from...... to....... Does this correspond to your record? Yes.... No....
5. He states that he left because..............................
Is this an adequate statement? Yes.... No.....
6. He states that he received in salary or commission........... per......... Is this correct? Yes.... No......
7. Would you reëmploy him? No.... Yes.....
8. If not will you please give reasons..........................
...
9. If you have further information that will assist us in helping him make the most of his opportunity, kindly indicate it.......
...
10. If you have further information that can better be given in personal communication with our representative, check here....

14. *Judgments Based on Photographs*

L. D. Anderson, "Estimating Intelligence by Means of Printed Photographs," *Journal of Applied Psychology*, 5:152-155 (1921)

Purpose.—(1) To determine the reliability of photographs for indicating the intelligence of strangers, and (2) to seek out differences in the ability of various persons to judge intelligence by this means. The results of the study might be applicable to problems of selection arising in an employment office.

Method.—The photographs used were prints (from cuts) in a handbook published by a large department store company. They represented the faces of 69 employees of that company. These persons consisted of superintendents, buyers, managers, and assistants.

In the fall of 1920 the same 69 persons were given the Bureau of Personnel Research adaptation of the Army intelligence test, and the scores in this test were used as the intelligence criterion. . . .

Twelve judges passed upon the photographs. These judges were selected from a nearly homogeneous group of graduate students and instructors in psychology and there was very little chance of other influences entering into the judgments of intelligence given.

Instructions—These photographs will introduce you to the 69 managers, buyers, and assistants of the———Company. You are asked to *estimate the intelligence* of these people by a careful study of their photographs.

First, scan through the book and get an impression of the general character of this group. Then pick out the following:

(1) The seven most intelligent persons
(2) The seven least intelligent persons
(3) The fourteen persons who are superior, but not as good as the best seven

(4) The fourteen persons who are inferior, but not as poor as the worst seven

The reason for the grouping by sevens is found in the fact that there are about 7 individuals in each decile. The highest 10 per cent, the next 20 per cent, the lowest 10 per cent and the next lowest 20 per cent are thus sought. This would leave an undifferentiated middle group of 40 per cent. The entire arrangement is thus intended simply to sift out the extremes.

TABLE I

SUCCESS OF VARIOUS JUDGES IN ESTIMATING INTELLIGENCE BY PHOTOGRAPHS

Judge	Number of Absolutely Right Judgments	Number of Absolutely Wrong Judgments	Number of Judgments on the Correct Side	Number of Judgments on the Incorrect Side
A	12	1	27	15
B	7	1	23	19
C	7	1	25	17
D	4	1	23	19
E	6	2	19	21
F	10	1	26	16
G	8	0	22	20
H	10	2	22	20
I	8	1	20	22
J	7	1	20	22
K	7	1	22	20
L	10	2	22	20
Total	96	14	271	231

In this table, "absolutely right" means that the man's photograph was assigned to the *exact group* into which the intelligence test placed him. "Absolutely wrong" means that the very superior man was marked very inferior or the very inferior man marked very superior. Placing the inferior man in the very superior group or the superior man in the very inferior group, etc., is indicated in the 4th column. "Judgments on the correct side" are those where superiority to the average has been rightly discriminated and where inferiority to the average has been rightly discriminated.

From the above table it will be noted that there are 96 absolutely right judgments and only 14 absolutely wrong judgments. . . . In the last two columns of the table there are 271 judgments on the correct side and 231 on the wrong side. These data show that the judgments of intelligence based on photographs are, in this experiment, fairly accurate where only the extreme degrees of intelligence

as measured by other criteria are involved. If all judgments are considered, i.e., if the middle group that is badly "judged" is included, there is a very slight tendency to accurate placement.

A product-moment correlation was made by assigning values to votes as follows: A judgment as very intelligent was given a rating of 2, a judgment in the least intelligent group a rating of — 2, a judgment of superior a rating of 1 and a judgment of inferior, a rating of — 1. The ratings given to each photograph were summed and a product-moment correlation of .27 with intelligence test scores was secured. The probable error is .07. This correlation shows that there is a positive relationship between photograph ratings and intelligence test scores. . . .

Conclusions.—It seems very doubtful whether for practical purposes intelligence can be gauged by a study of a man's photograph. The correlation of .27 between assigned ratings and intelligence as measured by the Bureau of Personnel Research Intelligence Test shows, however, that there is some tendency to discriminate intelligence above mere chance selection. From a study of Table I it was found that 16 men were placed at least once in both the most superior and the most inferior group, 49 people were placed in both the superior and inferior groups, 18 people were placed in both the most intelligent and the inferior groups and 29 were placed in both the least intelligent and the superior groups. From these results, it appears that selecting employees by a study of photographs would be a very haphazard way of selection. When competent raters placed men in both the highest and lowest classes 16 times out of a possible 69 chances, there is little possibility of upholding the practice of photograph rating.

D. The Employment Interview

15. *Functions and Techniques of the Interview*

W. V. BINGHAM and B. V. MOORE, *How to Interview*, chap. IV modified (Harper, 1931)

Three Functions of the Employment Interview.—Three functions have been recognized in the employment interview. In the first place, the interview is commonly the chief means of getting from the applicant the information on which selection is based. In the second place, the interview should serve to give the applicant a true picture of the position he is to fill and the firm he will be connected with. Not only the opportunities, but also the difficulties, discomforts, and exactions should be fairly presented. The third function of the interview is to make a friend of the applicant

or new employee. Here should be a medium for initiating a cordial and democratic spirit in the company. The successful interviewer puts himself in the place of the applicant in so far as is necessary to interpret the applicant's responses and general appearance in the interview. After he has decided to accept him, he starts from the applicant's point of view and sells himself, the job, and the company. Of course, overselling must be guarded against in order to avoid disappointment later. To sell the company, the interviewer must be enthusiastic about it and take the time to explain it. If the applicant is not fitted for the job, he should be led to realize the fact by a description of the exacting requirements. It is wise to take time to interview an applicant and show him kindness, even though there is no vacancy for him; for he can become a personal advertiser for the interviewer and the company.

Traits Which Can or Cannot Be Judged.—The practical question is how to improve the reliability of the interview for employment. The first step is to distinguish what can be learned by interview from what cannot be obtained in that way. The interviewer must realize that there are some data that cannot be secured in an interview. Charters has suggested some of the facts which the interviewer can and cannot determine. He states that the interviewer cannot tell how dependable, honest, persistent, or loyal a person is. He can form opinions on the appearance and manners of the prospect, his likeableness, his attitude toward the organization's kind of work, his outside interests and hobbies, his forcefulness, his mental brightness in conversation, and any disagreeable mannerisms. In other words, the interviewer can get impressions of those personality traits which are significant only in so far as people are impressed by them. Traits which do not actually function or enter specifically into the behavior of the interviewee during the interview cannot be judged with reliability by the interviewer.

Techniques of Interviewing.—The thought given to interviewing by practical interviewers has related chiefly to methods and techniques. The "art of interviewing" has been the subject of most of the articles published on the interview. Although very few of these make any reliable contributions, there are some helpful suggestions among them. We may consider first the attitude and approach of the interviewer toward the interviewee. For understanding the interviewee, and for gaining the greatest coöperation from him in getting at the facts of his qualifications, the interviewer must appreciate the situation of the interviewee. Many writers state that the interviewer must put himself in the shoes of the interviewee and show a sympathetic understanding. Such an attitude is good in so far as it aids in furthering the interview, but it

should not be allowed to interfere with an impartial evaluation of the fitness of the candidate for the job. The interviewer who is faithful to his own job and his company must be an impartial judge between the interviewee and the job.

Many successful interviewers emphasize the importance of placing the applicant at ease. The first step is for the interviewer himself to relax. The ideal interview has been described as a conversation in which the applicant is analyzed by *getting acquainted* with him, by talking with him about something in which he is interested. All men wish to be recognized in their interests.

To listen is an essential rôle of the interviewer. There must be at least that encouragement to the interviewee to reveal himself. Each question should fit the moment, based upon what has gone just before. With listening must be included also observation. Individual reactions are often symptoms of significant habit patterns which make the applicant fit or unfit for the particular position for which he is being considered. Although due allowance should be made for the strain on the applicant, a candidate who shows obviously undue nervousness is not suitable for many vocations. Even the personal appearance is highly important where success is effected by the impression given other people. Neither men nor women feel confident in buying clothing from a salesperson who is not well dressed. The public does not seek the window where they are waited on by a man with disfigured face or dirty finger nails. The interviewer will decidedly give attention to the physiognomy of the applicant, not for the purpose of reading character, but to decide how his appearance will impress the people with whom he is to deal. All aids should be utilized in connection with the interview for evaluating the qualification of the interviewee. The study of the applicant's fitness should include a preliminary interview, a psychological examination, a physical examination, and a final interview; but the applicant should not be engaged until an evaluation on the complete record of findings has been made.

Throughout the interview and in the use of all devices for the selection of employees, it must be remembered that the task is one of diagnosis. The interviewer looks for symptoms that indicate fitness for a job. The information one gets from an interviewee in an employment office is of value largely for the clues it yields. That is, various items of information furnish clues that help fill out the details of a picture which the interviewer is trying to build in his mind. It is a picture which fits the applicant into the job, or which rules him out of consideration. Rejection is not necessarily because of indications of inability of the applicant to do the work of the job, but may be because of his failure to show habit

patterns and temperamental dispositions, and mental health and strength, which offer a prediction of permanency, responsibility, good morale, and ambition.

16. *The Interviewer*

V. V. ANDERSON, "A Psychiatric Guide for Employment," *Personnel Journal*, 6:417-419 (1928); reprinted by permission of Williams & Wilkins Co.

It is the function of the interviewer to bring together, analyze, and digest all of the information that bears upon the suitability of an applicant for a given job as well as his general value as a personnel risk for other possible positions. He sums up all of this information into an individual diagnosis and decides to employ or reject the given applicant. The interviewer, himself, is the most important element in the entire employment situation. His knowledge, experience, interviewing technique and diagnostic ability became the index of the quality of personnel employed. Tests and other tools to be used can aid and guide him in getting a better knowledge of certain aspects of a given applicant's abilities but they will never alone and of themselves furnish sufficient information to afford a safe basis for securing employees, for they do not evaluate the entire personality. His special training and experience should have given him a clinical knowledge that forms the background for understanding the physical and mental factors that underlie faulty human adjustments bringing about failure at work or failure in other life situations. This knowledge constitutes an understanding of the personality, a diagnostic acumen that enables the interviewer to make satisfactory estimates of the possibilities in any given applicant for successful adaptation to work.

If sound progress in employment work is to be attained, we must cast aside theories of inborn, mystical ability to "size people up" or "to read character." What all honest investigators are after is a discipline that presupposes a knowledge and a technique—a discipline that offers something more solid than guesswork.

The issues involved in work adjustments do not differ in their fundamentals from those underlying behavior problems in other walks of life. These issues can be approached in the same scientific spirit that we have sought to understand natural phenomena in general. Long since have we discarded the idea that behavior disorders, either of children or adults are not amenable to an acceptable scientific method of inquiry. We are forced to deny the fact that people are just good or bad employees and that by some trick method the sheep can be picked out from the goats; nor do we

stand any longer for the belief that there is no known way of ever telling just how an applicant will behave in a given job situation. That these things can be investigated and fairly well understood and that they can be approached in the same scientific spirit of study that we have sought to understand other human problems is now an accepted fact.

It has seemed that there was a gulf between the practical, "hard boiled," experienced man of business with a good common sense background who does the employing, and the laboratory psychologist whose exact methods of measurement will have nothing to do with the shrewd "hunches" of the practical man. The first in his attitude toward scientific method oscillates between a naïve gullibility —swallowing hook, line and sinker—and open resistance and antagonism. On the one hand, we find employment people who expect a simple intelligence test to select good employees for them, as though the matter of cleverness or smartness was the principle determining factor in work success. On the other hand, we find interviewers who will have nothing whatever to do with the whole thing; this due either to a misunderstanding of the use of such methods, or to prejudice against a technique in which they themselves are not trained. In other words, the average interviewer does not utilize the psychological test at its proper value.

Some inexperienced industrial psychologists in their overweening ambition to settle at one blow all employment problems have sadly oversold the matter of psychological tests or have misunderstood their limitations. Hence the layman is apt to feel that the psychological test itself is the selective agent. The fact is that neither one of these groups is wholly right or wrong. The interview if properly conducted and intelligently interpreted opens up knowledge concerning the applicant's past history and ways of behaving that furnish the most fruitful basis for judging what his future adjustments are likely to be; while the results of the psychological tests disclose abilities and disabilities that, when properly interpreted by the well-trained interviewer in the light of all other information about the applicant, contribute an addition to employment technique that is invaluable. But neither by itself offers an adequate method for diagnosing potential work adjustments.

We have in the interviewing situation a problem to be attacked similar to that presented to the psychiatrist in diagnosing the factors underlying his patient's behavior disorder and making a prognosis of the future outcome. We have come to the conclusion that every phase of the study of a given case as it is carried out by the clinician can be utilized by the interviewer in determining the work adjustment possibilities of a given applicant.

QUESTIONS

1. Criticize the square-peg-in-the-square-hole concept of vocational placement. Explain the worker-in-his-work concept. Why is it called a biological concept?
2. What is the nature of the problems which would normally be referred to the plant personnel department? How would you classify them? How would you distinguish the duties of a personnel director from those of a production manager, finance officer, etc.?
3. What is the relation of a job analysis to a job specification? Illustrate each. For how many separate purposes may they be employed?
4. In your judgment, what are the relative values of (*a*) letters of application; (*b*) letters of recommendation; (*c*) photographs; (*d*) interviews?

CHAPTER V

RATING SCALES

Some attributes of a human being are very easily measured in an objective fashion. Structural features such as length of trunk and pulmonary volume are obvious examples. Behavior products such as speed of reaction to a visual stimulus, average time of association to opposites as compared with subordinates, tendencies to overestimate or underestimate lengths, etc., may be determined in the laboratory with similar independence of the observer's peculiarities. But many, if not most, human qualities must be estimated or judged rather than measured in the strict sense. Strength of grip may be accurately gauged by the amount of pressure exerted on a dynamometer; but beauty of countenance can be assessed only by the impression it makes upon the beholder. Relative intelligence can be found within a few points of error, while such a significant property as sociability will show wide fluctuations from judge to judge, even though the person to whom it applies probably has a constant amount of the trait.

It is to meet the need for some kind of measuring instrument for semiobjective or utterly subjective characteristics that rating scales have been devised. The chief advantage of such scales is found in the fact that they regulate to some extent the movement of a person's thoughts when appraising another man, help to focus consciousness upon specific items for consideration, reduce irrelevant material to a minimum, provide comparable estimates which can be treated statistically, and furnish convenient permanent records. We are constantly passing judgments upon each other, whether these judgments are formulated quantitatively or not. Superiors are always found comparing the relative worth of their inferiors, subordinates are matching bosses against each other in different respects, and equals are generally engaged in "sizing up the other fellow." The rating scale is simply an endeavor to introduce uniformity into a process which is normally performed haphazardly.

Since so much often hinges upon the outcome of a rating policy, it is important that it be properly executed. Salary increases, changes in title, advancement in authority, etc., are some of the issues which must be decided on this basis in the absence of any better criterion. Precautions which psychologists normally emphasize are: (1) the necessity for absolutely independent judgments; (2) a minimum of at least three raters; (3) the rating of each quality by itself without reference to any general impression; (4) the rater must have some acquaintance with the person judged but not be too intimate with him; (5) periodic recheck upon the ratee, since human traits are not fixed but in a constant flux. Even when these requirements have been met, great precautions are needed in interpreting the findings. The process of interpretation is often helped by recognizing that some traits have more external manifestations than others; e.g., efficiency and originality in a man are apparent to most observers because of the evidence which accompanies their exercise, while loyalty and agreeableness depend too much upon the individual effect they may make upon another. Traits in the former class tend to possess high reliability; traits in the latter usually rank low in reliability.

A. Kinds of Scales

1. *Principles of a Rating Scale*

B. V. Moore, "Charts That Help Pick the Right Man for the Job," ***Factory*, 25:383-384 (1920)**

Employers have always tried to estimate the value of a man as a whole, considering his qualities altogether without the use of a rating scale. Great differences in the estimates made by different persons on the same man have shown this to be an uncertain method. The man's qualities must be separated and rated by themselves; for if they are not, the estimator is likely to let his prejudices consider only one prominent quality and bias his judgment so as to neglect all other qualities. For example, a foreman or supervisor may possibly have a feeling of repugnance toward one of his workers because that worker has a disfigured face, and unconsciously the foreman overlooks the man's other good qualities. However, when the rating scale calls for a consideration of these qualities separately, he is forced to realize that the worker may be intelligent, industrious, skilful, and coöperative. After the fore-

man is led to face the facts in this way, he must admit that, after all, the man has good points that are valuable in a workman. On the other hand, the foreman may have to admit that he has been overlooking another workman's laziness and lack of skill because this man was always good natured and sociable. Moreover, the fact that these ratings are signed and given in black and white to a superior who can check them, leads the foreman to consider sources of inefficiency in his workers. It also makes him more careful and fair in his judgments of his men. We can then lay down as the first principle of the rating scale that:

1. Instead of trying to estimate a person's ability as a whole for doing any particular work, this ability is analyzed into component essential abilities or traits, and each trait is rated independently of the others. The traits selected should be the most important for success in the particular situation. It is much better to have a few traits that are really essential and critical for a worker's success than to have ratings on many traits, some of which are relatively unimportant. That is, it is much better to concentrate on a few important qualities and have ratings on these made and really used than to have a system so elaborate that it breaks down from its own size and complexity. . . .

The reliability of a rating scale as a measure of various traits depends upon the standards, particularly the definiteness of the standards which it sets up as measuring-rods. Therefore, other principles for making an accurate rating scale are to be observed, and these other principles are:

2. The different traits determined upon must be really different and as distinct from each other as possible. They must be supplementary to each other with the minimum of indefiniteness and overlapping.

3. For rating a person in any trait, the person doing the rating must be acquainted with the one to be rated, and have more or less dependable facts for making a decision. When an employee asks for a promotion or transfer, the employment manager cannot rate the employee in coöperation or in industry, but the worker's previous foreman probably could. On the other hand, the employment manager might be a better judge of the applicant's appearance and manner in considering him for transfer to the office or some place where he would meet the public.

4. The traits must be as sharply defined as possible so that different people doing the rating will rate the same trait. In naming and defining traits, use terms which are more or less common, and have, as nearly as possible, universally the same meanings

accepted by everybody, and the minimum chances of ambiguity and misunderstanding.

5. For rating an individual in a trait, the basis of comparison used as a scale should be as concrete and as familiar as possible. To provide this condition, the person to be rated is compared in regard to a particular trait with other and well-known persons who differ in the extent to which they have that particular trait. That is, a foreman, in rating a man, should compare him with men who are doing the same kind of work under similar circumstances; and the foreman must be well acquainted with traits and qualifications of the men.

6. Where more than one individual is to be rated in more than one trait, more comparable results are obtained by rating all individuals in one trait before rating any of the individuals in any other trait.

7. More reliable results are obtained by having a person rated by more than one person, ratings by three persons being recommended if it is possible to get them. These ratings should be made independently and then averaged. A revision of one rating by another person is not so accurate as a combination of two ratings made separately.

2. *Rating Scales*

H. E. Burtt, *Principles of Employment Psychology*, 317-318 (Houghton Mifflin, 1926)

A man may have the requisite intelligence, or memory, or speed of reaction for a given job, but he may lack industry, initiative, tact, enthusiasm, persistence, or other traits or attitudes or tendencies that are needed to supplement his ability in order to make him a successful worker. In the present status of our science these tendencies or attitudes or traits or aspects of personality as distinguished from capacity or ability cannot be tested. The best that we can do is to obtain the judgment of persons familiar with the man in question.

Such traits cannot be stated in terms of items per minute, or some other quantitative unit, but they are nevertheless important in vocational prognosis. Things like initiative, tact, coöperativeness, leadership, or organizing ability, may be of outstanding importance in selecting men for, or promoting them to, positions of an executive, supervisory, or salesmanship nature in which personal contacts are paramount. The best procedure at present available for obtaining an indication of the degree to which such traits are present is the rating scale. Such scales are utilized in various ways

by different organizations. Brief ones are used for estimating an applicant during an employment interview. Estimates of a systematic sort are obtained from previous employers, school teachers, or others who have been in touch with the applicant. Promotion from one department or job to another within an organization is a logical part of the employment program and it is for this purpose, perhaps, that rating scales are at present most widely used. Many concerns have their employees rated periodically by their superiors. The results, on the one hand, indicate cases of maladjustment where transfer or special training is requisite, and, on the other hand, serve to locate promotional material. In many concerns vacancies are filled from within the same organization and the rating scale is useful in discovering the most promising individuals for promotion.

3. *The Army Rating Scale*

COMMITTEE ON CLASSIFICATION OF PERSONNEL IN THE ARMY, *The Personnel System of the United States Army,* 2:252-254, 259-261 (Adjutant General's Department, War Department, Washington, 1919)

Reasons for Ratings.—The rapid increase in the personnel of the United States Army that was necessitated by participation in the war, and the consequent adoption of the principles of selection rather than seniority for the commissioning and promotion of officers, led to a demand for a standard method of determining and recording the relative efficiency of individuals. This standard method of selection was provided by the Rating Scale. By its use a superior officer expresses his opinion of the efficiency of his subordinates in the form of numerical ratings which can be instantly understood by any other officer in the Army, and which enable just comparisons to be made between any two officer-candidates or officers of the same rank.

The Basis of the Rating Scale.—Those who prepared the scale took into account the fact that human nature is hard to measure. It cannot be measured accurately by relation to any abstract standard of good and bad, for one man's conception of excellence differs widely from another's. *A man cannot be compared with a number. He can only be compared with another man.* Hence the only safe way to measure an officer's value is to compare him with another officer of known value. Just as the length of a line is measured by comparison with a standard length—the yard—or as a weight is determined by comparison with a standard pound, so the measure of an officer's ability is ascertained by comparing him with officers whose position on a scale of merit is known.

It is inconvenient, if not impossible, to find any one officer who

can be accepted as a standard in all the essential qualifications. In securing a basis for comparison, it was found expedient to focus attention separately on each essential qualification, choose separate standards for each, and make comparisons separately with respect to each. Thus an officer's *physical* qualities are considered apart from his other qualifications and he is compared with officers of well-defined and standard degrees of merit in physical qualities. The same method is followed in considering each of his other essential qualifications.

The Essential Qualifications.—It is necessary not only that comparisons be made separately for each qualification of an officer, but also that those qualifications be actually the *essential* ones. The process of finding the respects in which officers might be accurately compared and justly rated has been long and laborious. Many officers of the Army, including some of the highest rank, have coöperated in formulating the list of qualifications, and it now represents a composite Army conception of what a good officer should be. It also represents a composite Army interpretation of each qualification. For instance, "physical qualities" is not judged from the medical viewpoint of fitness, but is interpreted as meaning the way in which the officer impresses his men by his physical qualities.

The five essential qualifications of an officer are arranged and systematized on the Rating Scale, with such explanatory items under each one as are necessary to define its meaning clearly. An officer is then selected for each of five degrees of merit in each qualification. The result is a human measuring-rod against which any officer to be rated can be compared. For purposes of standard notation he receives the counts of the officer whom he matches or equals in each qualification. The sum of these counts is his total rating, which is a numerical expression of the degree in which he possesses the military qualifications deemed most essential: Physical Qualities, Intelligence, Leadership, Personal Qualities, and General Value to the Service.

Characteristics of the Rating Scale.—On the following page is reproduced a copy of the rating scale in use on January 1, 1919. It will be noted that it is really five separate scales, one each for each of the five essential qualities of an officer, namely, physical qualities, intelligence, leadership, personal qualities, and general value to the service. Each of the spaces is to be filled with the name of an officer who is taken as a standard for the qualification and the degree of the qualification indicated by the terms, "highest," "high," "middle," "low," and "lowest."

Each of these officers is ordinarily of the same rank as the rater

and hence the rank next superior to that of the officer to be rated. Each of them is well known to the rater and stands in his mind as an exemplar of the qualification. With each of them he compares the officer to be rated on a man-to-man basis to find which one he most nearly equals in that qualification. The officer to be rated is compared with officers of superior rank because the object is to discover his fitness for promotion.

The accuracy of the result depends largely upon the care with which the rating scale is constructed. When instructions are followed closely and raters do their work conscientiously the ratings show a high degree of accuracy and uniformity. No other selective system that has ever been devised so completely eliminates the personal equation or so justly determines merit.

Rating Scale

Qualification	Rating	Points
I. **Physical Qualities** Physique, bearing, neatness, voice, energy, endurance. Consider how he impresses his command in these respects.	Highest	15
	High	12
	Middle	9
	Low	6
	Lowest	3
II. **Intelligence** Accuracy, ease in learning; ability to grasp quickly the point of view of commanding officer, to issue clear and intelligent orders, to estimate a new situation, and to arrive at a sensible decision in a crisis.	Highest	15
	High	12
	Middle	9
	Low	6
	Lowest	3
III. **Leadership** Initiative, force, self-reliance, decisiveness, tact, ability to inspire men and to command their obedience, loyalty and co-operation.	Highest	15
	High	12
	Middle	9
	Low	6
	Lowest	3
IV. **Personal Qualities** Industry, dependability, loyalty; readiness to shoulder responsibility for his own acts; freedom from conceit and selfishness; readiness and ability to co-operate.	Highest	15
	High	12
	Middle	9
	Low	6
	Lowest	3
V. **General Value to the Service** Professional knowledge, skill and experience; success as administrator and instructor; ability to get results.	Highest	40
	High	32
	Middle	24
	Low	16
	Lowest	8

4. *The Graphic Rating Scale*

W. D. Scott, R. C. Clothier, and S. B. Mathewson, *Personnel Management*, rev. ed., 178 ff. (McGraw-Hill, 1931)

In one form the Graphic Rating Scale is a sheet or card so printed that the executive can indicate his judgment of the subordinate in each important quality by entering a check mark at the proper point on a horizontal line, one end of which represents the maximum degree in which anyone can possess that quality, the other the minimum degree in which anyone can possess that quality. The intermediate steps are indicated by words and phrases pertaining specifically to the quality itself; such general adjectival phrases as Excellent, Good, and Average are avoided wherever possible. One of these scales is given to the executive for each subordinate whom he is to rate. He indicates his opinion of him in the several important qualities by entering check marks along the several lines somewhere between the minimum and maximum. The scales are then scored by stencil in the Personnel Department and the scores, after statistical treatment to allow for individual rating tendencies, are entered on the Qualification Cards of the employees who are rated. Thus, the Qualification Cards become more than history cards; they indicate the employee's present equipment in those abstract qualities such as Judgment, Initiative, Enterprise, and Coöperativeness which influence his effectiveness in his work so greatly.

It is obvious that the Graphic Rating Scale overcomes most of the weaknesses which are inherent in the adjectival and numerical scales and in the Army man-to-man scale. Experience has shown that when it is carefully administered it yields ratings which are most apt to be reliable and that executives and foremen usually coöperate in fullest measure in their use. The scale is easy to use; undue time and effort are not required. . . .

When the qualities have been carefully selected and when the definition of each has been carefully worked out from the point of view of clarity and precision of meaning, then attention is given to those phrases and adjectives which are to be used to indicate the varying degrees with which a person may possess such quality. Ordinarily it is advisable to use five such adjectives or phrases to indicate five progressive degrees within each quality, from the extreme minimum to the extreme maximum. There is nothing binding about this, however. Under certain circumstances it is undoubtedly advisable to use six, four, or even three steps within each quality.

As implied above, it is important that these adjectives and

phrases should be selected with particular reference to the quality itself. This gives them special significance. . . . The phrase "Learns with ease" is much more significant than the word "Good" would be. The word "Dull" is much more significant than the word "Poor" would be. Such carefully selected adjectives and phrases picture the worker to the rater with reference to that particular quality in a way which is otherwise quite impossible. They direct our attention without effort on our part to the degree with which the person being rated possesses that quality. . . .

Conversely, general adjectives and phrases such as Good, Average, Poor are avoided wherever possible. They are disturbing to the person's ability to concentrate on the quality itself.

5. *A Rating Scale in Use*

E. D. BARTLETT, "A Practical Rating Scale," *Industrial Psychology,* 2:564-565, 567-569 (1927)

Not so many years ago employees were selected almost solely on the basis of impressions made during a personal interview between the applicant and the employer. Although this condition still exists as regards many smaller concerns, among the larger companies numerous improvements have been made in the plan of procedure which materially aid in making a more satisfactory selection.

To the personal interview have been added the printed application form, psychological test, physical examination, etc., so that it is now possible to measure, with considerable accuracy, an individual's mentality, education, physical fitness, and experiences. So far, however, it has proven impossible, or at least impracticable, to gauge the applicant's initiative, honesty, conscientiousness with much greater certainty than in the old days before the personnel manager existed. We still depend upon references and the personal interview. Upon this interview is based the final decision: To hire or not to hire. This article offers no substitute for the personal interview but does offer a suggestion that should help to make the selection less of a "hunch" and more of an unbiased analysis.

All personnel men (I hope) will admit that they are subject to the same prejudices as other men. They have their likes and dislikes. One will have an almost morbid horror of forwardness, so much so that the exhibition of this failing will frequently blind him to whatever good points the applicant may have. Others find it difficult to resist a flatterer, particularly the one who uses the old bromide, "A real judge of men like yourself." But regardless of our particular weakness, the fact remains that most of us too

frequently allow one characteristic to influence us far beyond its actual importance.

As an example of the above statement the writer recalls an instance that occurred when he was filling an important position a few years ago. A certain applicant was interviewed for the position after passing the various intelligence and specialized ability tests with flying colors. His education was rather exceptional and in addition his experience had been along the lines of personnel research. All in all his application was rather unusual.

Upon being introduced, the writer was struck with such a close resemblance to a personal friend that the two men could have been taken for twins. So close was this resemblance that during the entire interview the writer found it impossible to free his mind of the feeling that he was talking to the friend instead of to the applicant. As this friend was an exceptionally able man there was a very strong urge to employ at once. Fortunately, this temptation was successfully resisted and the applicant finally dismissed with, however, the determination to phone him an offer later in the day. Casually and as a matter of form only, the writer started to mark the Characteristic Sheet shown in the following figure:

APPROACH	SLOUCHY	AWKWARD	TIMID	EFFUSIVE	FORWARD	WELL POISED	ALERT
FACE & HANDS.	REPULSIVE BLEMISHED	COARSE HOMELY	COMMONPLACE UNTIDY	PAINTED WEAK	PALE FLORID	DARK GOOD-LOOKING	PRETTY STRONG
PHYSIQUE.......	CRIPPLED	STOUT	THIN	WEAKLY	PASSABLE	WELL-BUILT	
DRESS	CHEAP	FLASHY	CARELESS	WORN	NEAT	GOOD TASTE	
SPEECH	ILLITERATE STAMMERING	NERVOUS ACCENTED	LOUD	QUICK	SLOW	QUIET	REFINED
PERSONALITY ...	SULLEN CONCEITED ARGUMENTATIVE	TACTLESS SARCASTIC OBSTINATE	TALKATIVE DOGMATIC FLATTERING	INATTENTIVE PHLEGMATIC DEJECTED	RETICENT ATTENTIVE SOBER	TACTFUL ENTHUSIASTIC HAS "PEP"	MIXER LIKEABLE AMBITIOUS
HEALTH	POOR	FAIR	GOOD	NERVOUS			
HONESTY.........	INSINCERE	DOUBTFUL	EVASIVE	FRANK	SINCERE		
MENTALITY	STUPID	ECCENTRIC	FAIR	GOOD	STUDIOUS	EXCEPTIONAL	
EDUCATION.......	IGNORANT	PRACTICAL	THEORETICAL	WELL INFORMED			
JUDGMENT........	ILLOGICAL	IMPULSIVE	SLOW	LOGICAL	RAPID	INITIATIVE	

EST. GREATEST POTENTIALITY	PLANT			BUSINESS	SALES	ACADEMIC	
	OPERATION	RESEARCH	CONSTRUCTION				
ADMINISTRATIVE							
ROUT. WORKER .							
INDIVIDUALIST..							

ATTITUDE TOWARDS				
	STARTING SALARY	UNREASONABLE	QUESTIONABLE	REASONABLE
	ADVANCEMENT	UNREASONABLE	QUESTIONABLE	REASONABLE

CODE: ✓ INDICATES FULL VALUE OF WORD
✓✓ INDICATES EMPHASIS
◻ MINIMIZES VALUE OF WORD

CHARACTERISTIC SHEET

A descriptive term or qualitative form of rating scale

Every check was favorable until the word "talkative" was reached. While under the spell of the man's personality as a whole, the writer had been unable to pick out a single flaw but, placed under the microscope of the Characteristic Sheet, the very pleasing personality of the individual was separated into its constituent parts and the fact that he was talkative made evident. A second interview and a

careful investigation of his references revealed the fact that this was his solitary bad point. There is an element of humor in the fact that, after being informed of the reason for his rejection and allowed a third interview in which to convince that the fault was not incurable, he talked two solid hours trying to prove he could keep quiet.

The above is inserted as a practical example of how an undesirable characteristic may be hidden under a favorable general impression. Similarly, some very desirable characteristic may be hidden under a poor surface.

It is to avoid unfair judgment based upon general impressions that we devised our Characteristic Sheet. Naturally it would have been much easier to have taken a course in character analysis but, unfortunately a study of the claims put forth by various character analysts and phrenologists has failed to convince us that the claims were based upon anything more than buncombe or misplaced enthusiasm. . . .

After several months experimenting we decided to use a qualitative form of scale. Our first sheet had about half the characteristics shown in the final form so that we found ourselves forced to write in characteristic after characteristic in long hand. We then revised this form so that it included practically all of the characteristics shown in our present sheet, with about fifty per cent more. A check-up here showed that we had gone a little too far in the other direction so that a second revision was made giving us the form which we have in use at present.

Our qualitative form of scale has eleven main divisions printed in the order that they impress the interviewer. Thus, APPROACH is listed first, then FACE & HANDS, PHYSIQUE, etc. After each main heading is given a number of qualifying adjectives. These may seem to the casual observer to be too few or too many. Our experience indicates that the number is about right, at least for our use. We have practically no occasion to add any characteristics and we do use all those that are included in the form. For example, under APPROACH we have listed both "Slouchy" and "Awkward." This may seem unnecessary inasmuch as the two words are so closely related. Examination, however, develops the fact that a man may be awkward and yet a very desirable employee while the slouchy individual very rarely is. It is, therefore, desirable to know whether a man is awkward or slouchy.

Further along we have "Effusive" and "Forward," another pair of rather closely related words. This same situation is repeated throughout the form. A careful examination, will reveal the fact

REVISION A, MAY [illegible]
AMERICAN COUNCIL ON EDUCATION
[illegible] PLACE, WASHINGTON, D.C.

PERSONALITY REPORT

The information on this sheet is confidential

Name of student ______________________ **Name of institution** ______________________

Please return this sheet to ____

Selection and guidance of students are based on scholastic records of achievement health and other factual records Personality, difficult to evaluate, is of great importance You will greatly assist in the education of the student named if you will rate him with respect to each question by placing a check mark on the appropriate horizontal line at any point which represents your evaluation of the candidate

If you have had no opportunity to observe the student with respect to a given characteristic, please place a check mark in the space at the extreme right of the line.

In the rectangle below each rating scale please describe briefly and concretely significant performances and attitudes which support your judgment and which you yourself have observed

Let your statements answer specifically the questions of the rating scale by showing how the student manifested the qualities mentioned

Do not be satisfied with the statement of an opinion concerning matters of fact, if the facts themselves can be presented

Select those illustrations of conduct which are consistent with the personality of the student as you have observed and understood it

Bear in mind that from as many accurate observers as possible the college desires to secure concrete descriptions of the student s personality as exhibited in many situations and that the purpose is an understanding of the student s personality as a whole so that he and all concerned with his education may guide his development to the highest

The following items illustrate the way in which observers have reported evidence in support of their checking of the highest answer to the second question (B):

Of a college senior "In my course in Elizabethan drama he voluntarily built to scale models of the Blackfriars Theater and the Fortune Theater based on the work of Chambers, Albright and others and demonstrated Elizabethan methods of staging several of the plays read "

Of a college senior "Independently collected and classified correctly one hundred type specimens of fossils found in the neighborhood of the college."

Of an eighth grade boy "Finding in English assignment, the introduction to Burns' 'The Cottar s Saturday Night' a reference to Robert Fergusson's 'The Farmer's Ingle as a possible inspiration of Burns' poem he looked up Fergusson s poem in the home library and compared it with that of Burns At the same time desiring to read Burns in the Scottish way he mastered the phonetic system of Sir James Wilson s 'The Dialect of Robert Burns as spoken in Central Ayrshire which he also found in the home library, and so interested the boys of his class in the pronunciation of Scottish words that even at the end of the year the lads still called each other by appropriate Scottish nicknames and used Scotticisms which they found in Burns and Wilson."

"At the age of eleven began collecting diatoms from local ponds and streams and studying their forms under his own microscope Now possesses collection of microscope slides, including some presented to him by scientists in Department of Agriculture and Carnegie Institution, specimens collected by Shackleton, Scott and other expeditions "

How well do you know this student? ____

____

____

____

Signature **Date** **Position** **Address**

(over)

GRAPHIC RATING

that while these words at first may appear synonymous, they are really distinct.

In marking the form it is well to bear in mind that all of the characteristics shown are used both in an affirmative and in a negative manner. For instance, if we check "Sullen" we mean that he is sullen. On the contrary if we do not mark sullen we mean that in our opinion the individual is not sullen. This being the case it is not sufficient merely to mark a few high points here and there. We must either rate carefully or not at all.

Name of student ______________________

A. How are you and others affected by his appearance and manner?

Avoided by others | Tolerated by others | Liked by others | Well liked by others | Sought by others

No opportunity to observe ____

Please record here instances that support your judgment.

B. Does he need constant prodding or does he go ahead with his work without being told?

Needs much prodding in doing ordinary assignments | Needs occasional prodding | Does ordinary assignments of his own accord | Completes suggested supplementary work | Seeks and sets for himself additional tasks

____

Please record here instances that support your judgment.

C Does he get others to do what he wishes?

Probably unable to lead his fellows | Lets others take lead | Sometimes leads in minor affairs | Sometimes leads in important affairs | Displays marked ability to lead his fellows makes things go

____

Please record here instances that support your judgment.

D How does he control his emotions?

Too easily moved to anger or fits of depression, etc. | Tends to be over emotional

Unresponsive, apathetic | Tends to be unresponsive

Usually well balanced | Well balanced | Unusual balance of responsiveness and control

____

Please record here instances that support your judgment.

E. Has he a program with definite purposes in terms of which he distributes his time and energy?

Aimless trifler | Aims just to "get by" | Has vaguely formed objectives | Directs energies effectively with fairly definite program | Engrossed in realizing well formulated objectives

____

Please record here instances that support your judgment.

SCALE FOR STUDENTS

In using our rating scale we do not, as is so often recommended, check the form while talking to the applicant because we find that by doing this the applicant is made ill at ease. We may occasionally check one or two characteristics but no attempt is made to fill out the form completely until after the applicant has left the office. The interviewer then, as a matter of routine, runs down the form and checks, according to the code, the various characteristics applicable to the individual interviewed.

The criticism may be made that an interview, lasting possibly

only a few minutes, is hardly sufficient to allow the forming of definite opinions upon every characteristic shown on the rating sheet. We have, however, had very little difficulty in this respect, particularly as we became more familiar with the make-up of the form. In interviewing, we deliberately feel out the applicant to see whether or not he possesses the important factors influencing success, and also to ascertain whether or not he has any of the common qualities that tend toward failure. In marking up the sheet we usually discover that the analysis has consciously or unconsciously comprehended almost every characteristic printed on the form.

We do not consider our rating form as a sure means of judging character. It is rather a means of arriving at a properly analyzed impression. When we check "Dishonest," we do not mean that the applicant is dishonest but that he impresses us as such. He is not necessarily rejected on this account but is subjected to a more careful investigation than usual. This applies to the sheet as a whole. It might be well to state here that in addition to the Characteristic Sheet, we ask the applicant to fill out a rather comprehensive application form which asks for age, marital state, education, nationality, experience (type of work done and reason for leaving each position), height, weight, etc. It is therefore safe to assume that any information which seems to be lacking in the Characteristic Sheet is available in some other form.

When we first started using the Characteristic Sheet we found that the rating made by one interviewer often differed radically from the rating made by other interviewers of the same person. This was due to the fact that the various characteristic adjectives meant different things to the different interviews. We, therefore, conducted a rating class in which we all rated the same individual and then compared ratings. In a very short time the situation was cleared up so that the different ratings compared very closely with each other. From time to time we repeat this checking up to avoid a recurrence of such a condition.

The Characteristic Sheet also plays a very important part as an aid to memory. Having no resemblance at all to the famous person who remembered, "Mr. Addison Sims of Seattle" so well, the writer after interviewing Mr. Sims and then talking to several hundred other individuals, has great difficulty in recalling that Mr. Sims ever existed. If, however, he can take out Mr. Sims' Characteristic Sheet and glance over it, he has a word picture of the gentleman which is frequently almost as vivid as it would have been immediately after the interview.

6. *Graphic Scale Plus Concrete Evidence*

Rating scales have evolved through various forms as the weaknesses of the earlier forms were revealed by use and analysis of results. Since the greatest need was for measuring more or less abstract qualities, the rating scale necessarily depended much on subjective evaluation of traits. This often resulted in ratings that were not comparable because the bases of judgment were not comparable. Efforts to remedy this defect resulted in scales for rating not abstract traits but types of behavior. Furthermore, the judgments were to be supported by specific instances illustrating the quality of behavior. One of the best examples of this more refined type of rating scale is one devised by a committee of the American Council on Education (pages 138 and 139).

B. Factors Influencing Judgment

7. *Qualification of Judges*

H. L. Hollingworth, *Vocational Psychology and Character Analysis*, 97-98 (Appleton, 1922)

Does the possession of a trait accompany ability to judge that trait correctly, either in self-estimation or in the judgment of others? Is the best inspector or superintendent of teachers one who herself excels in the art of instruction? Is the best literary critic one who is himself an artist in composition? Is exceptional journalistic aptitude a prerequisite of distinguished editorial work? Put in these forms the question assumes more than a theoretical interest, and it is a question on which practical policies do not seem entirely agreed. While we cannot pretend to solve the whole problem, we can at least show what was the case in our own inquiry. For we have measured the ability of each individual to judge himself and others, and we have also measured the standing of each judge in the traits considered. What relation exists between these various measures?

The table below gives the results. The figures give the correlations (coefficients of agreement) between possession of a trait, or standing in it, on the one hand, and on the other hand, ability to judge that trait correctly either in self-estimation or in judging others for their possession of it.

In general the more "admirable" the trait, the closer is the relation between possession of it and ability to judge it. The three

traits we have classified as "reprehensible" give either very low positive correlations or, in four cases out of the six, negative coefficients. The latter cases suggest that lack of the trait in question is more likely to characterize those who are able to judge it, and this relation is especially clear in the case of judgments of the self. If then we define a trait as a desirable characteristic or aptitude, the inference is that in the long run the ability to judge the trait tends to be an accompaniment of the possession of it, and that the degree of the ability to judge varies directly with the degree of the possession of the trait.

Correlation Between Possession of Traits and Judicial Capacity

Trait	Relation between Possession of a Trait and Accuracy of Self-estimation in That Trait	Relation between Possession of a Trait and Ability to Judge It in Others
Humor	.87	.59
Refinement	.83	.38
Intelligence	.59	.49
Sociability	.47	.48
Neatness	.45	.22
Beauty	.15	.23
Conceit	—.22	.19
Snobbishness	—.27	.33
Vulgarity	—.37	—.24

8. *The Halo Effect*

E. L. Thorndike, "A Constant Error in Psychological Ratings," *Journal of Applied Psychology*, 4:25, 27-29 (1920)

In a study made in 1915 of employees of two large industrial corporations, it appeared that the estimates of the same man in a number of different traits such as intelligence, industry, technical skill, reliability, etc., etc., were very highly correlated and very evenly correlated. It consequently appeared probable that those giving the ratings were unable to analyze out these different aspects of the person's nature and achievement and rate each in independence of the others. Their ratings were apparently affected by a marked tendency to think of the person in general as rather good or rather inferior and to color the judgments of the qualities by this general feeling. This same constant error toward suffusing ratings of special features with a halo belonging to the individual

as a whole appeared in the ratings of officers made by their superiors in the army. . . .

The same constant error appears in the correlation of the total Scott rating with a rating for technical ability as a flyer in the case of aviation officers. It is known from abundant evidence that technical ability as a flyer is a rather highly specialized quality. Considering the restricted range of the aviation cadets, the correlation between general ability for officer work and technical ability as a flyer could hardly be above .40, without any attenuation. As attenuated by the imperfections of the rater's knowledge of both, it could hardly be above .25. Yet the correlations for the eight raters studied in this respect are .74, .85, .52, .91, .63, .72, .47 and .53, an average of .67. Obviously a halo of general merit is extended to influence the rating for the special ability, or vice versa.

Mr. Knight of Teachers College has studied this same effect in the case of 129 teachers rated by their superior officer for certain qualities on the Boyce score card. The ratings in question were official and were used to determine salaries and promotions. General merit as a teacher has correlations of .68 with intellect, .79 with power in discipline, and .63 with voice. It is clear that the rating of a teacher's voice must have been influenced by the general impression of her ability. Voice correlates .50 with "Interest in Community Affairs," and .63 with intelligence!

. . . In the cases so far the correlations are a resultant of (1) the real facts, (2) the constant error of the "halo," as we may call it, and (3) the reverse error of attenuation due to chance inaccuracies in the ratings. In certain further work by Mr. Knight the correlations are freed from the last influence, by being based on the composite rating of two groups, each of a number of teachers who knew the individuals to be rated fairly well. The self-correlations of the ratings by one such a group with ratings for the same trait by the other group are over .90. The correlations for general ability as a teacher with intellect and with ability to discipline are about .95 and .80! The correlation of intelligence and ability to discipline is about .80! The correlations of a standard test of intelligence with general ability as a teacher and with ability to discipline are, for the individuals in question, not over .3.

The writer has become convinced that even a very capable foreman, employer, teacher, or department head is unable to treat an individual as a compound of separate qualities and to assign a magnitude to each of these in independence of the others. The magnitude of the constant error of the halo, as we have called it, also seems surprisingly large, though we lack objective criteria by which to determine its exact size. As a consequence science seems

to demand that, in all work on ratings for qualities the observer should report the evidence, not a rating, and the rating should be given on the evidence to each quality separately without knowledge of the evidence concerning any other quality in the same individual.

QUESTIONS

1. Specify the conditions under which rating scales are to be used.
2. What are the advantages and disadvantages of recording the rating of a person during or after the interview?
3. Since few, if any, rating scales are highly reliable, should they be used? What determines whether a rating scale is of value for a particular purpose?
4. Explain why rating scales may need to be different for use by different persons or in different situations.
5. Explain the difference between *constant errors* and *variable errors.*

CHAPTER VI

MENTAL TESTS AND INDIVIDUAL PLACEMENT

To the popular mind, intelligence testing and psychology are practically synonymous. This result is attributable largely to the excellent newspaper publicity given to the findings of the Army Alpha and their real or assumed social significance. Since the war most freshmen have become aware of the existence of the psychology department because the initial ability tests have usually been administered under its auspices.

However erroneous this impression may be, it is nevertheless true that mental tests (which include much more than sheer intelligence tests) do bulk large in the literature of contemporary psychology. More than a thousand distinct tests are available in commercial quantities for almost any conceivable purpose. Some are as indispensable to the applied psychologist as the stethoscope and sphygmomanometer are to the practicing physician; others are of but occasional usefulness; and some are positively worthless. Here it is particularly true that professional discrimination is essential to a wise use of these tools.

Measures of general intelligence or brightness are perhaps of maximum service because there are very few situations in which knowledge of a man's native capacity does not explain much of his fate. For many industrial tasks, there is no "substitute for brains." In some it may be perfectly irrelevant. In the latter case, it is customary to appeal to special aptitude or trade tests because industry is more concerned with asking, "Can this man run a press safely?" than "What is this person's mental level?" Special aptitude tests exist because individuals exhibit an unevenness of traits, due either to varying rates of development or unequal original endowments.

The chief use of tests is to select those persons who will be likely to be successful at particular jobs and eliminate those who are poor risks. How do we know who will succeed and who will fail? Either by following up the candidates after they have been with the company for some time and noting the

relationship between the scores made on the test and the productivity and skill of the workmen; or (as is more customary) by trying out the test of mature hands of known degrees of ability. The proposed test has discriminatory powers if the good men make high scores and the poor men make low scores. If no such differentiation is obtained, the test must be rejected.

The question is often raised, Is not injustice occasionally done to some candidates? Admittedly, not all persons who score low on a performance test will fail on the job, nor will all who do well make good. But this is because other factors, such as industry, ambition, interest, etc., complicate the prediction. In the long run, the experimental evidence demonstrates that those who are superior in any function at the outset tend to be such at the end, and *vice versa*. True, this does not hold for each individual; but in most psychological testing we are dealing with mass quantities in which the burden of probability must be followed.

An important theoretical point should be stressed here. Most mental tests aim to be measures of *capacity* rather than of *ability*. The former refers to aptitude or native potentialities for achievement, the latter to actual manifest accomplishment. The difference is often significant. From a long-distance viewpoint, it would be more profitable for an employer to engage a workman with high capacity but low ability than one who, even though he excelled the former in present ability, would ultimately prove below him in capacity.

A. Measures of General Intelligence

1. *The Principle of a Psychological Test*

A. W. KORNHAUSER and F. A. KINGSBURY, *Psychological Tests in Business*, 3-4 (University of Chicago Press, 1924); reprinted by permission

The principle of the psychological test is to use a sample of one's behavior to indicate his abilities or other tendencies, and hence to predict his probable future behavior. This is indeed the basic principle of any sort of test, psychological or otherwise—measuring a representative sample for the purpose of predicting what other samples are likely to be. The grain buyer does not need to examine each grain in a carload of wheat, nor does the structural engineer need to measure the strength of every beam that goes into a build-

ing. Having assured himself that the sample of grain or the single beam is typical of the rest, he grades or tests that sample and pins his faith to the uniformity and constancy of the conditions which produced those results. Similarly, when we give a typing test, a cancellation test, or an intelligence test to an individual, we assume that the internal conditions which determined his score on the sample are so constant that we can rely on his doing likewise under any similar conditions. The test then is given for purposes of prediction.

2. *Kinds of Intelligence*

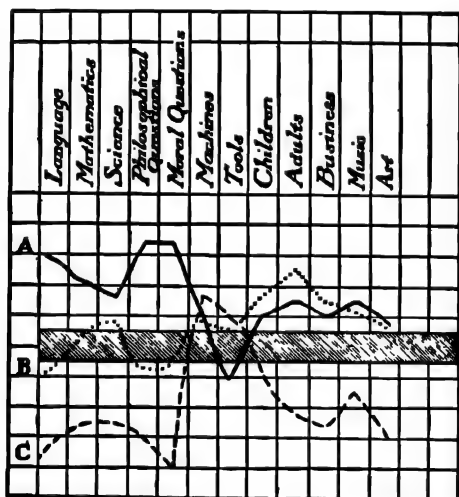
E. L. Thorndike, "Intelligence and Its Uses," *Harper's Magazine*, 140: 227-229 (1920)

As a sample to illustrate both what the scientific study of personnel has done and what it has to do, we may take the problem of intelligence and its uses.

Men talk freely about intelligence, and rank their acquaintances as having very little, little, much, or very much of it. If, however, they try to state just what it is, and how it is to be measured, there is difficulty. One says, "It is thought-power; and it is measured by the person's ability in school and in life." Another retorts, "What is thought-power?" and calls attention to the fact that ability in school and ability in life are different things. Smith declares that "Intelligence is ability to learn," and when asked, "To learn what?" adds, "To learn anything." A teacher present then observes that one of the slowest boys at learning Latin whom he ever knew made record progress in learning to swim, skate, and play ball. Jones, who has turned to the dictionary, says: "This suits me, '*Readiness of comprehension!*' I call a man intelligent who can understand questions—see the point. Give me fifteen minutes' interview with a man and I can give you a measure of his intelligence." Some one at once objects that a man may be slow and incorrect in responding to questions, but quick and sure in locating the trouble with an automobile, or in seeing a bargain, or in sizing up the temper of a mob of strikers.

The facts of everyday life, when inspected critically, indicate that a man has not some one amount of one kind of intelligence, but varying amounts of different intelligences. His ability to think with numbers may be great; his ability to think with words small. He may be a successful student of history and a failure at learning physics. Compare Grant's intelligence in using an army with his intelligence as a business trader. In our ratings of men we unconsciously strike a sort of average of his abilities in learning,

thinking, and acting. The source or cause of this average ability is what we really have in mind when we speak of his intelligence.

Numerous scientific investigations of human intellectual abilities confirm and extend this view. No man is equally intelligent for all sorts of problems. Intelligence varies according to the life situations on which it works. A man so feeble-minded in most matters that he is confined in an asylum is found to play a first-rate game of chess. A man who in his day was famous the country over as editor, speaker, and executive never was able to pass freshman mathematics in college. Such extreme cases are, of course, found rarely. There is a general rough correspondence or correlation, such that a man notably intelligent in one respect will usually be above the average in others also. But the correlation is far from perfect. Shakespeare was successful as a business man, and doubt-

INDIVIDUAL DIFFERENCES IN KINDS OF INTELLIGENCE
Shaded area represents average intelligence of the adult American

less would have made a good record as a lawyer, farmer, statesman, navigator or grammarian; but no competent person believes that his intelligence was equally adapted to all these. The general fact may be kept in mind in the form of a diagram like the figure above. The continuous line represents the intelligence possessed by individual A, the height of the line representing the amount of intelligence. The dotted line tells the same story for B. The dash line tells the same for C. A is on the average the more intelligent, and C the least; but B surpasses A in several respects, and C surpasses A in two.

A perfect description and measurement of intelligence would involve testing the man's ability to think in all possible lines, just as a perfect description and measurement of the mineral wealth of a state would involve adequate testing for iron, copper, gold, silver, lead, tin, zinc, antimony, petroleum, platinum, tungsten, iridium, and the long list of rarer metals.

For ordinary practical purposes, however, it suffices to examine for three "intelligences," which we may call mechanical intelligence, social intelligence, and abstract intelligence. By mechanical intelligence is meant the ability to learn to understand and manage things and mechanisms such as a knife, gun, mowing-machine, automobile, boat, lathe, piece of land, river, or storm. By social intelligence is meant the ability to understand and manage men and women, boys and girls—to act wisely in human relations. By abstract intelligence is meant the ability to understand and manage ideas and symbols, such as words, numbers, chemical or physical formulæ, legal decisions, scientific laws and principles, and the like. Mechanical intelligence and social intelligence refer to thought and action directly concerned with actual things and persons in one's hands and before one's eyes. When the mind works with general facts *about* things and people, as in the study of physics and chemistry, or history and sociology, its action is referred to abstract intelligence.

Within any of these intelligences a man displays relatively great consistency. The man who learns carpentering quickly and well could commonly have done nearly as well as a mason, sailor, plumber, millwright, or auto-repair man. The man who succeeds as a politician would commonly have done well as a salesman, hotel clerk, confidence man, or, if provided with certain accessory traits, as a parish priest or school principal. The boy who cannot learn algebra, history, and sciences will probably be unable to learn law, engineering, philosophy, and theology.

Between one and another of the three there is relatively great disparity. The best mechanic in a factory may fail as a foreman for lack of social intelligence. The whole world may revere the abstract intelligence of a philosopher whose mechanical intelligence it would not employ at three dollars a day!

3. *Intelligence Tests and School Grades*

L. L. THURSTONE, "Intelligence Tests for Engineering Students," *Engineering Education*, 13:263, 287-290, 303-305 (1923)

In the fall of 1919, Committee 22 on Intelligence Tests of the Society for the Promotion of Engineering Education induced a

number of engineering schools to participate in a coöperative study of the predictive value of various kinds of examinations. Interest at that time was directed toward intelligence tests, trade tests, objectively scored examinations, and other recent developments in examination technique. The committee was asked to investigate the possible practical usefulness of these new types of examinations for engineering schools. The results of such an investigation might reasonably be expected to bear on the provision of entrance requirements and entrance examinations for engineering colleges.

Description of the Tests

Six tests were used in this investigation. These were called (1) arithmetic, (2) algebra, (3) geometry, (4) intelligence, (5) physics, and (6) technical information.

Test I: Arithmetic Problems.—One might at first sight object to the use of a test in arithmetic with high school graduates who have already demonstrated by high school certification that they are entitled to admission to an engineering course by the customary entrance criteria. This objection would probably be based on the fact that arithmetic as a separate study is not pursued beyond the grammar grades and that the high school student is supposed to have mastered the four fundamental operations. We have included an arithmetic examination in the series, however, with several definite objectives in mind. The test questions have been so selected that they should appeal to the student with engineering interest. The arithmetical calculations called for are of the simplest kind, but the interpretation of the problem which precedes actual calculation requires that the student think in terms which should be interesting to the engineering student. It is not unusual for a student to possess the necessary arithmetical ability for this test who thinks that he cannot pass it simply because he is not sufficiently interested in the content to stop and read it carefully. This test is in one of the best tests for the prediction of freshman scholarship in engineering.

The arithmetic examination differs from other examinations for the college freshmen mainly in that the problems are relatively simple. It presupposes that the bright and successful student will solve more of these simple problems in the given time than his less gifted classmates. The differentiation between the students is therefore largely a matter of speed in doing what they all can do.

Test II: Algebra Problems.—This test does not deviate markedly from other algebra examinations. The test contains twelve algebra problems and was given under conditions similar to those of Test I. The time limit for this test is also thirty minutes.

Test III: Geometrical Construction.—The purpose of this test is to determine whether the student is able to apply the principles of plane geometry to simple problems in construction. We have assumed in devising this test that it is possible for a student to memorize the propositions in plane geometry without being able to apply them on the drawing board. The test problems are as follows:

1. Bisect this angle. Show all your construction lines.
2. Draw any triangle with a perimeter equal to the given line. Show all your construction lines.
3. Divide this line into three equal parts. Show all your construction lines.
4. Draw a right-angled triangle with this given line as its hypotenuse. Show all your construction lines.
5. Draw a square so that its area will be equal to the sum of the squares on the given lines. Show all your construction lines.
6. Locate the center of this circle. Show all your construction lines.
7. Draw a line through the given point to the given line so that the angle formed will be equal to the given angle. Show all your construction lines.
8. Extend these two lines and connect them by an arc of ½ inch radius. Show all your construction lines.
9. Draw an arc of ¾ inch radius so that it will be tangent to the given arc and the given straight line. Show all your construction lines.

The given geometrical data in the form of the necessary lines and arcs were printed in the test pamphlet.

Test IV: Intelligence Examination.—The purpose of an intelligence examination is to ascertain as far as possible the native mentality of the candidate irrespective of his formal education. It is probably not possible to exclude from an intelligence test score the effect of formal education but the intelligence tests in general use certainly minimize this factor as far as possible. The intelligence test used in this study is a combination of five of the best known intelligence tests; namely, analogies, opposites, number completion, the proverbs test and the syllogism test.

Test V: Physics.—This test consists of a series of simple problems in physics. The problems are so stated that the student must select on his own initiative the principles that apply in the solution. The test does not call for any repetition of principles from memory. In fact mere repetition of memorized material is discouraged throughout all these examinations.

Test VI: Technical Information.—In this examination we attempted to ascertain how much general technical information the candidate had acquired during his high school career on his own

initiative and by his own interest. For this reason the items are mostly such as would represent activities outside of school. They cover such technical information as a boy would acquire from reading popular technical journals, constructing mechanical toys, inquiring about automobile engines, wireless telegraphy, and the various mechanical and electrical appliances in his immediate environment. If a boy has acquired an extensive fund of such general and semi-popular technical information one may be justified in assuming that his interests are fairly stable toward the engineering profession.

The following are some sample items from the test:

Answer these questions by underlining one of the four given answers for each question.

1. A magnet attracts
   brass copper <u>iron</u> platinum
2. An air rifle uses for ammunition
   .22 short <u>BB shot</u> .32 center fire Cb caps
3. In making a core for an induction coil one ordinarily uses
   mahogany rubber copper <u>iron</u>
4. Harley-Davidson is the name of a
   <u>motorcycle</u> electrocouple wireless detector aeroplane
5. R. P. M. represents
   volume <u>speed</u> content direction

Almost 7,000 freshmen engineering students completed these six tests in 49 different colleges and universities. Some of the results are summarized as follows:

An examination in algebra for thirty minutes gives on the average higher predictive value with reference to freshman engineering scholarship (.42) than the high school grade in algebra (.29). This represents the average for all the colleges in which the records were compiled. An examination in physics for thirty minutes gives practically the same predictive value (.34) as the high school mark in this subject (.33). The half-hour test in constructive geometry gives practically the same predictive value (.30) as the high school grade in the same subject (.29). The entrance examinations in algebra, arithmetic, physics, chemistry, and geometry give higher predictive value with reference to freshman engineering scholarship than the intelligence test. This is to be expected because of the heavy loading of mathematics and physics in the freshman engineering curriculum. The half hour intelligence test gives higher predictive value for engineering freshman scholarship (.29) than the high school grade in English (.27)

although this difference is hardly sufficient to be considered stable and significant. The two criteria are practically comparable in diagnostic value. The average marks in a three-hour examination program including all six of the tests gives a much higher predictive value for engineering freshman scholarship (.46) than the average mark in the four-year high school course (.29).

It may seem strange that a three-hour examination should give more reliable prediction of the student's capacity for college work than his average attainment in four years of high school work. This finding is probably due to the fact that the high school grades vary considerably, the same mark meaning different standards in different schools. The examinations were conducted as uniformly as possible in all the participating colleges and the papers were marked in a predetermined way.

4. *Individual Differences in Employees*

MARION A. BILLS, "Predicting the Careers of Clerical Employees," *Service Bulletin of the Bureau of Personnel Research*, 5:2-4 (1920)

Story of Sally Jones.—The first story is about Sally Jones. Twelve years ago Sally graduated from high school. It might have been from the eighth grade as far as it affects this story. Her family would not have considered letting her go into factory work or becoming a counter sales girl, but clerical work had a more respectable air. She applied for and secured a position with a large company. Several hundred other "sweet girl graduates" of that year did the same thing. Back in Sally's mind was the firm conviction, although she would not have admitted it even to herself, that the work was temporary. She thought of it as a good fill-in for a year or two,—then marriage and a home of her own. So did practically every one of the hundred graduates.

The work that Sally was given was routine work but she rather liked it. It kept her just busy enough and did not distract her mind from the things which to her at that time were the really important things of life. She certainly liked the intimate association with the other girls in the office, the stolen visits about last night's dance and the lunch hour discussions. Sally, however, was conscientious and gave value received on her job, though she used her rather keen mind only enough to satisfy her conscience.

At the end of five years, 75 per cent of the clerks who had entered with Sally were married. Another 10 per cent had gone into some other work. Two college graduates who came in at the same time were running a tiny tea shop. There was a girl who had gone into advertising and one who was painting really clever Christmas cards.

But for some reason Sally had not married and, having no special genius for other things, had stayed on with the company.

Gradually, very gradually, during these five years Sally's viewpoint on what constituted the important things of life had changed. She still went to dances and picnics but the next day she thought primarily of the job and not the dance. At the end of four years, because Sally had been conscientious, because at least for the last few months she had been doing decidedly better work, and because a better position happened to open up, Sally was promoted. The new job was interesting and more and more her mind continued to dwell on her work. As a result another promotion came in a short time, which likewise directed her mind to the work and thus the inevitable circle of more interesting work, closer attention, more interesting work began.

Sally was sorry, in one way, for she was leaving her best pal, Mary, behind. Mary's and Sally's careers up to this point had been the same. Fate had not happened to make either join the eighty-five per cent that had left, but from this point their careers separated, for "Sally had brains," so her chief said in comparing her to Mary. Mary was still doing the same routine work. She did not mind the work, particularly; overcoming its difficulties was more interesting than otherwise (there had always been more difficulties in the work for Mary than for Sally) but she would have liked more pay. However, on a whole, she took it fairly philosophically. Sally took too many chances and introduced too many ideas for her. In time Mary hopes to be chief of the section of routine work that she is in.

Today Sally is buying all the paper for the company and is spending a half million a year. Her outside interests are a bit more staid than they were twelve years ago but even at forty she will not be the spinster that Mary is at thirty. They have both become permanent employees of the company. They may marry and leave but the chances of that are no greater than that any man may leave for a better position.

Two months ago Sally and Mary both took an intelligence test, their respective scores being 140 and 83. With this information twelve years ago, any personnel director could have predicted their future careers provided they remained with the company. No one could have predicted whether or not they would be of the 75 per cent to take on matrimonial bliss.

5. *Intellectual Levels of Girls in Industry*

EMILY T. BURR, "Minimum Intellectual Levels of Accomplishment in Industry," *Journal of Personnel Research*, 3:210-211 (1925); reprinted by permission of Williams & Wilkins Co.

In machine operating jobs the findings demonstrate that thirteen years is an adequate intellectual level. As a result of an experiment in training girls of subnormal mentality to operate electric power sewing machines, however, it was found that girls of from a mental age of six years and eight months to ten years and eight months could learn to run such machines. In industrial concerns, however, girls who have not been trained and who have as low a mental rating as ten years, frequently leave the job indicated after a period ranging from one day to five weeks. The reason given for dismissal is often "spoiled goods" or "too slow" or "cannot learn job." The experiment is too recent to furnish definite data as to just what careful individual training in machine operating may accomplish for girls of a low grade of intelligence.

The simplest machine jobs are the sewing of window shades, garters, and powder puffs, all being articles that are handled readily by girls of a mental age of twelve years. Straight seam sewing, the stitching of corsets, and art linens (this includes the sewing on of braids, bindings and upholstery) require an intellectual level of thirteen years. The straw hat sewers, the workers on the Zig-Zag machine and hem-stitching machine in industries where the girl must learn to thread and adjust the machine demand an intellectual level of thirteen years. The completion of an entire garment which demands judgment, extreme accuracy and a ready adjustment to different varieties of material, requires an intellectual level of thirteen years also.

Hand Sewing is a trade offering manifold opportunities to the group of girls served by the Bureau. Hand-sewing jobs have been grouped into (1) the mounting of materials, buttons, novelties and the like on cardboard, work which can be performed by girls of a mental age of nine years; (2) sewing bows on novelties, also a possible task for a nine years mentality, provided the girl has received previous training in school; (3) hand sewing on garments which does not demand any speed can be done by girls of ten years mentality, while the next grade of work, sewing on labels, does necessitate quick work, and although the mental age of ten years is sufficient, we find only a twelve years mentality persevering through the three-month period.

There are other jobs such as pencil-making, where girls of a mental age of eight years and seven months are making good;

paper-box-making which seems to require at least a nine-year level; winding cotton and wool braid, in which occupation girls of ten years and six months mental age have remained on their jobs; the hooking up of dresses for a model which is being done by a nine-year-old, but no group statistics are available as yet.

6. *Limitations of Mental Tests for Manual Workers*

A. S. OTIS, "The Selection of Mill Workers by Mental Tests," *Journal of Applied Psychology*, 4:339-341 (1920)

The writer was called in 1919 to the office of a large and progressive silk manufacturing company in Connecticut to "install a system of mental tests for prospective employees" (both clerks and mill workers). Bringing to bear his experience in mental testing in the army and schools the writer constructed two systems of intelligence tests, one for clerks and executives, similar to the Otis General Intelligence Examination, and a comprehensive performance intelligence examination somewhat similar to the performance tests used in the army for foreigners and illiterates. This latter was for all mill workers, a large percentage of whom were foreign or illiterate.

The clerical intelligence test proved to be of decided value in the selection of members of the office force and has been adopted for permanent use. It is not the purpose of this article to discuss this test.

The results of an extended tryout of the performance intelligence examination, however, are both startling and baffling and cast an ominous shadow over the future of strictly intelligence tests for manual workers.

The performance scale used in this connection consisted of 13 tests covering a wide range of mental and manual activity. The examination of an individual lasted on the average an hour. In all some 400 employees were tested. These were placed in three groups according to their productive ability ascertained by careful investigation. In the last analysis it was found that the correlation between intelligence and productive ability was zero! No amount of age grouping or length of service grouping would bring anything but zero out of the correlations.

That the tests did measure intelligence one may be perfectly confident, first, because for the most part they were standard tests which have been used in one form or another for years—picture puzzle, drawing designs, paper folding, etc. The ability of clerks in these tests was found to be distinctly above that of mill workers as a class. Secondly, the intercorrelations between the several tests

ranged between .40 and .75 denoting a "reliability coefficient" for the whole scale of .97. When 13 widely varying tests tend strongly to measure the same ability that ability must be "general ability" or intelligence.

The writer is not prepared to say that it is proven conclusively that there is no correlation between intelligence and efficiency in mill work, for various reasons. It cannot be asserted confidently that every examinee did his best on the tests. There was lacking the incentive that is present when an applicant seeks employment. These examinees were already employed and saw no purpose in the tests. Moreover, the rating in productive ability was not as refined as could be desired due to numerous difficulties which could not be overcome in making the ratings. Furthermore, it was not possible to test such individuals as had failed to learn to weave or spin or be worth employing in some branch of the industry. These might have shown a lesser intelligence as a group.

On the other hand the difficulties above mentioned are only such as would be expected to "attentuate" the correlations—to reduce the true correlations to, say, one half or less. But a correlation must be pretty small in the first place if one half or one third of it equals zero! We are forced to conclude therefore that intelligence is a very unimportant factor in efficiency in silk mill work.

The psychologist can hardly rest content with such a conclusion without some sort of explanation, considering the known correlation between intelligence and clerical ability or executive ability or scholastic ability, military ability, etc. The following is suggested as a possible explanation.

Firstly, the machinery of the present day is so efficient and automatic that very little intelligence is needed to use it. Moreover, machine work is so specialized and monotonous that an intelligent person is very likely to revolt at it after a moderate period. The writer met one person who said she had sat in the same chair every work day for 18 years at her occupation of pasting strips of white paper around the edges of cardboard boxes. Yet she seemed entirely contented with the work and said she liked it. Some weavers had worked in the same mill for 35 years. Many persons do nothing but put full spools of silk in place of empty ones, week after week, year after year, with seeming contentment. Others do nothing but cut imperfections from thread and tie the ends—the imperfections being located by electric machinery automatically. Others do nothing but tie knots in breaking thread. Weaving is perhaps the most skilled operation in the mill. The operation of a loom is probably no more complicated than the operation of an automobile, yet three months are devoted to teaching a "weaver learner." It

would seem that almost any degree of intelligence could be taught in that time to thread bobbins, tie knots, watch for imperfections, etc. The man who was considered the best weaver in the mill, having never failed to "make bonus" for a long period, took something like ten minutes to assemble the parts of a simple picture puzzle of twelve square pieces which intelligent persons had assembled in 25 seconds, and he was then satisfied to leave the ear under the chin. Another good weaver could not put the mouth under the nose in 25 minutes!

The conclusion which the writer draws from these researches is that intelligence is not only not required in a modern silk mill for most operations but may even be a detriment to steady efficient routine work. What qualities are required remain to be sought. Whether they are measurable is doubtful. They may be stolidity, patience, inertia of attention, regularity of habits, etc.

The field of industrial psychology as applied to manual labor is believed by the writer to be virgin soil.

B. Special Aptitude and Trade Tests

7. *Kinds of Tests*

A. W. KORNHAUSER and F. A. KINGSBURY, *Psychological Tests in Business*, 15-20 (University of Chicago Press, 1924); reprinted by permission

Standardized and Unstandardized Tests.—A psychological test is by no means unique. It is a refinement of methods we are crudely using every day. When a layman is first introduced to a psychological test he may be surprised that it is so simple, and may think he could go ahead and devise one himself. Doubtless he could. In fact, a great many people with no psychological training have tried it. But whether the product will have any value is another matter. Anybody can take a stick and put marks along its length, but whether these marks mean inches or centimeters or nothing in particular is another question. Anybody can prepare a list of questions or set down a number of problems of the sort he has seen in some test, but if these are not standardized nobody can tell what any given response to them means, except in terms of his own subjective opinions. For anyone else they are worthless.

An ambitious but untrained amateur sets out to devise a test for a given occupation. He prepares a series of 100 questions and announces that 90 per cent answered correctly shall be regarded as passing. Then a technically trained tester happens along and begins to quiz him, asking such questions as:

Are these questions worded absolutely unambiguously? How do you know?

Are they all of equal—or accurately graded—difficulty, so that one means as much, and should mean as much, in the score as any other?

Is there a fixed time limit? Why? Or why not? If so, is it made and kept absolutely uniform whenever the test is given?

Will a slow reader or a slow writer make a lower score than one who reads or writes rapidly? If so, is it a trade test or a reading-writing test?

Will any subject be certain to get the same score, no matter who gives the test? How do you know?

Will he be certain to get the same score, no matter who marks it? Is there any way in which a generous marker can score him higher than a hard marker could? If not, how has this personal element been eliminated?

Has the test itself been tested?

Why is 90 set as the passing mark? Did you decide arbitrarily? If so, what proof of the correctness of this figure have you? Did you decide by taking the test yourself? If so, what evidence have you that your performance is the correct standard? Or did you try it on a group of workers?

How many workers have you tested with it? Is this enough to constitute a reliable sample?

How did you pick out these workers? At random, or did you select cases favorable for your purpose?

Did the successful workers all score 90 or above? The poor workers 89 or below? If not, do you know how reliable it is in separating these groups?

How did you determine which are "good" and which "poor" workers? Was that a reliable method?

Is this test available so that other people can try it out under precisely similar conditions and compare their results reliably with yours? Are your results available for such comparison?

The well-meaning amateur has perhaps never thought of some of these things at all, or he cannot give answers that prove the test score to be a reliable, valid, and accurately interpretable sample measurement. True, even a standardized test may not rank A + on all these points. But if the test-maker knows how close to reliability it is, that is worth a great deal.

Such considerations distinguish the standardized psychological test from one which is nothing more than "somebody's guess." To work out and establish a sound technique, to obtain accurate norms for comparison and interpretation of test results, and to determine the validity and reliability of a test—these demand thorough psychological and statistical training on the part of the test-maker. His psychological training suggests to him, in the light of what he

knows about human behavior, the sort of material and method of presenting it which will call forth the traits he wants to measure. It aids him in finding standards, against which to check up his beliefs about what the test measures. It makes him keenly alert to countless sources of error, unsuspected by the layman, which complicate psychological experimentation. It shows him how to guard against these errors. It helps him to understand the real significance of high or low test scores. His statistical training teaches him how to work out many details of technique; how to ascertain the validity and reliability of the test; how and where to get comparative standards of norms; and how to express these norms so as to permit accurate comparisons.

Classes of Psychological Tests.—Perhaps it will help us to get a clearer notion of the nature of psychological tests, as well as to appreciate their infinite variety, if we try to classify them in various ways. Any classification, we should remember, is no more than a convenience. It cannot be a rigidly mechanical affair, since there are literally hundreds of different standardized tests, all of which differ in some detail from every other, and consequently no two of which measure exactly the same thing. From whatever standpoint we choose to group them, there will be some tests whose nature is such that we would be equally justified in including them in any of two or more groups. With these precautions, let us proceed. The simplest way of classifying tests is into (1) individual tests, and (2) group tests. The earliest tests were mainly of the first sort, designed to be given to one person at a time. Group tests are more recent and involve a somewhat different technique. Indeed, the first widely used group intelligence test was that used in the United States Army in 1917-18. It is harder to maintain uniform controlled conditions with fifty subjects at a time than it is with one. Nevertheless, the great economy of being able to test from fifty to five hundred people in the same time it takes to test one has led to the rapid multiplication of group tests during the past few years.

Another possible basis for classification is in terms of the form of response which the conditions of the test call for. These may be either (1) oral responses, (2) writing or marking, or (3) performances of any other sort. While individual tests may utilize any or all of these types of response, group tests usually necessitate writing or checking. Since people vary in their normal speed of writing, it is usually desirable to eliminate this complicating factor by having the subject respond by underlining or making a check mark opposite one of several alternative responses printed in the

test. While all non-verbal tests may be classified as performance tests, it is hardly worth while to subdivide these, since, as will appear later, the kind of performance called for varies with every test.

We could, if we chose, classify tests as to their use, as (1) educational, (2) industrial, (3) clinical, (4) military, and (5) social. But the value of such a classification disappears when we notice that many tests may be used equally well for several purposes. The Army Alpha test, for example, has been widely used for every one of the previously mentioned purposes.

Classes of Test Organization.—Tests may be classified as to their form of organization, namely: (1) single tests, (2) test groups, and (3) scales. The second and third classes refer to groups of simpler tests, used either to get supplementary measures of the trait being tested, or to test a more complex trait, or perhaps to test a group of more or less closely related traits. Test groups differ from what are sometimes designated as "scales," in that the latter combine the scores of the separate tests into a single figure—a composite or one-dimensional score—while in the test group we record the scores of the separate tests of the group separately, thus affording a more analytical, multi-dimensional description of the subject's performance.

Test groups (which, of course, means something quite other than group tests) are of diverse character, and a further word about the forms they take may not be amiss. Some of them are referred to as profile tests. Thus the Downey will-profile test measures twelve distinct volitional or temperamental tendencies, and the twelve separate scores are graphically recorded in such a way that the line connecting them depicts the individual's will-profile. Still another example of grouping tests is the battery of tests which the employment psychologist finds by experiment are measures of the traits necessary for a specific occupation. While one may prefer to combine, according to some formula, the separate scores of such a battery into a single figure, thus making a scale of it, he may, on the other hand, prefer to reveal, instead of to conceal, the scores on the separate tests and use the profile, test-group, or analytical method of describing a subject's performance. Seashore's series of tests for the various elements entering into musical aptitude exemplifies this latter procedure.

While other possible classifications of tests might be suggested, we shall mention only one more, for many purposes the most suggestive. This is in terms of the kinds of ability or tendency the tests attempt to measure.

Functional Classification of Tests

1. Tests of proficiencies
   (*a*) Educational tests
   (*b*) Trade tests
2. Tests of aptitudes
   (*a*) General aptitude tests
      (1) General intelligence tests
      (2) Mechanical aptitude tests
   (*b*) Special aptitude tests
      (1) Physical tests
      (2) Motor tests
      (3) Sensory tests
      (4) Tests of other special mental functions
3. Tests of character and temperament traits

8. *The Construction of Tests*

Frank Watts, "The Construction of Tests for the Discovery of Vocational Fitness," *Journal of Applied Psychology,* 5:240-247 (1921)

How may we classify the tests already in use? One broad method of classifying them would involve their division into analytic and synthetic tests, the former representing the method of investigating separately the various mental and physical factors which enter into the performance of a piece of work, while the latter type stands for the attempt to measure vocational aptitude as a unitary capacity. Synthetic tests may be further subdivided into the various sample tests such as (1) vocational miniature tests, oral trade tests, picture trade tests, written trade tests, and performance trade tests; (2) empiric tests, which at present represent the application of the method of trial-and-error in vocational psychology; and (3) analogous tests which, combining the advantages of the analytic and the sample tests, will, I venture to believe, prove the only satisfactory means in the long run for diagnosing potential as distinct from actual vocational aptitude of a non-routine kind. Let me describe what I conceive to be the advantages and the disadvantages of each type of test as far as experience permits me safely to do so. I shall venture to take a point of view which is slightly different from that of other workers.

The analytic test, as has been indicated already, attempts to isolate and measure separately in respect of individual applicants for employment those physical and mental factors which are predominantly demanded in the given occupation. There are obvious limitations to the utility of this method. One could hardly employ it to take an extreme example from outside our subject, in determin-

ing whether a man (or woman) were suitable for the life-occupation of husband (or wife). Firstly, it would be well-nigh impossible to analyse out into clearly distinct factors all the various mental capacities called for in the state of matrimony. Secondly, if such an analysis were achieved it would be practically useless to attempt to isolate each factor involved for separate investigation and measurement; for how could one be sure of dealing with any one quality with the certainty that it was completely detached from others intimately associated with it? Thirdly, even if those two insuperable difficulties were removed we should still need to know in what proportions the single elements entered into the composition of the complete capacity, and this raises an important problem which I have never seen faced by anyone who has recommended or employed the analytic method of testing vocational fitness. This problem is one of deciding how to "weight" the scores for the various single capacities so that the total score is really a representative score. I have already indicated in another paper that by "weighting" the scores for important capacities in a number of subjects, rankings may be obtained quite different from those obtained when weighting is neglected. Fourthly, to continue our objections, the analytic method assumes that a psychic whole is merely the sum of the factors into which it can be conveniently split up, and this assumption ought not to be accepted in the absence of proof. The belief which would seem to be justified is that personality is not thus arbitrarily to be divided up into part capacities without loss. To use a homely illustration, an unanalytic factor of experience may result in two women producing two entirely different cakes with similar ingredients mixed in the same proportions, the baking conditions being constant.

Professor Seashore's patient analysis of the requirements of the singer into something like forty different qualities, though an ingenious piece of work from one point of view, would hardly seem, therefore, to be useful to the vocational psychologist in search of a test of singing ability. Separate investigations by scientific methods regarding the range of voice, the ability to sustain tones, the memory span, the delicacy of pitch discrimination, the association type, "mental plasticity," creative imagination, and so on, would prove to be unnecessarily tedious and probably highly unsatisfactory in view of the difficulties already indicated.

Let us take two potential singers, A and B, who may have happened each to score a hundred marks in a series of tests applied in accordance with the analytic method. Unless they have made identical scores in the separate tests—which is unlikely—does it help us to say they have been "scientifically" proved to possess

equal ability or promise? A has scored heavily in one direction because he possesses a magnificent natural voice, but B who lacks such an asset has made up for this deficiency by the possession of marked creative imagination and control of feeling. So that all we can gather from the elaborate tables of results would be, what we probably knew already, that A excelled in one way and B in another.

There seems to be justification, then, for suspecting that in all but the simplest cases the analytic method will probably prove worthless. It is where routine work is concerned and the chief capacities called for are no more than one or two of the sensory or motor functions which are almost mechanical and practically divorced from the higher forms of intelligence, that the analytic test may be useful, and useful here because the intellectual factor does not complicate significantly the various capacities measured. But even then there may be dangers in ignoring in any series of tests the intellectual factor, as we shall hope to show later.

The method of "the empiric test" is strongly recommended by Hollingworth (who, however, admits it to be a "rough provisional and unanalysed expedient") as representing "the most promising experimental procedure for the immediate present and perhaps for some time to come."

It is a method which necessitates no preliminary psychological analysis of tasks. The experimenter simply applies a number of miscellaneous standardised tests, e.g., the *completion test,* the *analogies test,* the *cancellation test,* etc., and notes how closely the scores obtained correspond with estimates of trade ability. Those tests which correlate highly with such trade estimates are then accepted as suitable for diagnosing capacity for the occupation under consideration.

"Perhaps the most perfect example of this purely empirical procedure," writes Hollingworth, "is the investigation which has now been conducted for several years by Mrs. Woolley and her co-workers in Cincinnati. Children who leave the grades to enter directly into some sort of industrial occupation, are examined by a miscellaneous assortment of simple mental tests. These records are preserved and the subsequent successes or failures of the pupils in the various sorts of work undertaken by them in later life are as carefully recorded as possible. It is hoped that when a sufficient amount of material of this nature has been accumulated, the two sets of data may be compared and information thereby secured concerning the relation between ability in the tests and the types and degrees of industrial fitness."

To argue anything of a general nature from this special applica-

tion of the empiric method is to assume that the interests of boys and girls are either permanent or change in an orderly and predictable manner. But tests which interest the boy or girl while at school and tend therefore to call out a maximum of ability in their performance may cease to attract in later years; so that *if applied later* they must inevitably produce results which are not to be relied upon to the same extent as data for diagnosing vocational aptitude.

But speaking generally, the empiric method is unsatisfactory because it is at best nothing more than a makeshift method for avoiding the difficulties of psychological trade analysis. To continue to employ this method without at the same time making an attempt to psychograph the work concerned is a procedure which will not be commended by any thinking person. The empiric method, more than any other, places us completely at the mercy of *sampling errors* where our human material is concerned, and of the errors, too, of the trade expert upon whom we must rely for trade rankings of the individuals tested. One of the greatest troubles in vocational testing is to find foremen who can give unbiased judgments about the bare vocational aptitude of the workers under them! There is always the double tendency present, which few but the most highly trained observers can control, to pass a favorable judgment upon those whose temperaments "fit in" readily with their own so as to make for a harmonious working relationship, and also to see specific aptitude in what Thorndike calls a "halo" of general ability, but never apart from it in its own shape and outline. Thus in the vocational world the empiric method of test construction in effect, shows us the blind leading the blind. Only when we are still completely unsure of our vocational analysis should we be content to employ the empiric method of test construction, and even then not blindly but for the deliberate purpose of opening up a way to a further knowledge of the psychological requirements of an occupation.

The various types of sample tests which have been advocated indicate an attempt to move away from the confusion of theory created by the analysts and the empiricists. But we shall see that if the theorists have unduly neglected the practical requirements of industrial tasks the practical men who have devised trade tests have equally neglected to consider the theoretical implications of their procedure. To take first the commonest form of the sample test which has been used, viz.: the trade performance test. Here we see the applicant for employment given an actual sample of the work which he may later be called upon to perform. His fitness or unfitness is to be gauged from an inspection of the results. This is a method which lends itself readily for use in a large

number of occupations; for example, in the choice of typists, clerks, musicians, athletes, skilled artisans, etc. The principal conditions for its successful application would seem to be: (1) that, at least, a representative part of the work is suitable for performance as a test without serious modification and (2) that the results can be expressed quantitatively.

The performance test-method is not without its pitfalls. At first sight it may not seem to call for any great psychological insight and yet to proceed without regard for the influences and effects due to unfamiliarity with the test conditions, lack of practice, fatigue, the use of unstandardised samples, and unstandardised instructions, nervousness, etc., all of which can only be negatived by the employment of scientific methods of procedure is to risk serious error. Moreover, we must know before we can judge a sample piece of work what an average performance is, and this will necessitate considerable research in every case. To be successful, therefore, the sample performance test must be applied under controlled conditions and the results interpreted in relation to known standards. An intimate acquaintance with the methods of experimental psychology will alone ensure that these conditions and standards have been obtained.

The vocational miniature test is a special form of the sample test possessing its general disadvantages with particular ones of its own in addition. It calls upon the subjects of experiment to deal with small "toy" representations of the actual work to be done. Thus a switchboard much reduced in size, may be used for testing telephonists, or signalmen may be required to manipulate tiny levers in response to demands for signals. It must be at once apparent that the number of tasks which can be reproduced in miniature is extremely small. But the method has been adversely criticised on account of its own intrinsic defects. Münsterberg quite rightly says that "a reduced copy of an external apparatus may arouse ideas, feelings, and volitions, which have little in common with the processes of actual life." There is no defence which can seriously be put up against this criticism.

Moreover, as far as physical labor is concerned, there is reason to believe that ability to perform the fine movements called for in working with small models is not at all indicative of ability to perform the larger movements of the actual work which the small model is intended to represent. In the two cases not only will different muscular and nervous co-ordinations be necessary, but also different types of interest. Thus the watchmaker and the miniature-painter would usually be completely unsuited "temperamentally," as we say, as well as physically for employment respec-

tively upon steam-turbines and motor-generators, or upon big poster work. In other words, there is probably no "general factor" in motor ability.

The oral trade test, the picture trade test in which a picture of a tool or piece of work is shown, and the written trade test are all types of sample tests based on the questionnaire method. Such tests obviously, are meant to elicit, and can elicit, nothing more than information. If these tests are used as supplementary to performance tests they may be employed to serve a useful purpose. But most of us harbour the prejudice that to know all about a game of skill or a trade is by no means proof that one is an expert in it, so that if such tests are used as substitutes for performance tests then the general question is raised as to the relation which exists between skill and knowledge, and whether the latter can be accepted as adequately representative of the former. For the elucidation of this problem everything will depend on the type of question asked and the knowledge presupposed in the individual circumstances. In many cases it is, I believe, a mistake to attempt to measure a bare ability independent of experience, because such experience may be the only proof of the presence of the interest upon which permanent efficiency depends. But it would seem on the whole that this type of test is one which can easily be coached for, if we are to take the American Army oral, picture, and written trade tests as truly typical of the method.

The chief objection, however, which the vocational psychologist will be inclined to raise against all sample tests, of no matter what kind, is that they may measure actual rather than potential capacity. They will not help us to select from among individuals without experience of a task those who would benefit most by training. The type of psychological test which is most urgently demanded—the true vocational test, that is, is the test which can be applied to those about to enter an industry with the idea of gauging their probable fitness in advance, so allowing us to advise the misfits to choose another occupation before it is too late. The only satisfactory test which promises well from this point of view (as a means of choosing workers above the routine level) is the skilfully constructed analogous test. The fact that particular analogous tests have not been altogether successful in the past is no argument against their real value.

The analogous test method calls both for a tentative psychological analysis of the work to be done and for the construction of problems calling out as a combination the essential capacities and interests concerned, in much the same proportion as they are demanded in the actual tasks, but in such a manner as to allow

potential capacity, when necessary, to compete on equal terms with capacity already fully developed. Really, therefore, it may often become in practice the sample method purged of its peculiar defects. It will be agreed that the work of constructing such tests is no simple matter, but it will prove, I believe, the only real way of progress.

Münsterberg's famous test for the discovery of car-driving aptitude was, up to a certain point, a test fulfilling these requirements. It was defective, not because of any inherent unsoundness in the analogous method, but because it issued from an incomplete analysis of car-driving aptitude. The method was employed by Münsterberg to replace the unsatisfactory method of vocational miniature which had proved defective. "Not the external similarity of the apparatus," wrote Münsterberg, "but exclusively the inner similarity of the mental attitude," should be the chief characteristic of a test which is intended to reproduce the conditions of work in any occupation. This inner mental attitude is usually so difficult to analyse that it is not surprising that few excellent vocational tests have so far been constructed. Vocational psychography, that is to say, is still little more than a mere phrase.

9. *The Scope of Psychological Tests*

H. C. LINK, *Employment Psychology,* 195-197 (The Macmillan Co., 1919)

How much can tests tell us about an individual? And how much importance may we attach to the facts which they reveal? Is it possible to say that, because an applicant passes the tests for a certain kind of work, that applicant will make good? And is it possible to assert, with equal assurance, that the reverse will be true, and that one who fails in the tests will fail in the work? Here, again, a distinct limitation must be immediately admitted. The application of psychological tests does not make it possible to predict, without qualification, that a certain individual will succeed at a certain kind of work and that another will fail. They only enable one to say that the chances for success of a particular individual or group are better than the chances of another. In brief, psychological tests do not make it possible to discover *all* that it is desirable to know about an individual, or, consequently, to prophesy infallibly what an individual is bound to do.

In the first place, there are innumerable factors which enter into the history of each individual which no method whatsoever can take cognizance of, and which, therefore, no method can control. Every employment manager is familiar with the many reasons other than the item *failure* or success which enter into the coming and going

of workers. Any comprehensive labor-turnover report contains as reasons for employees leaving items such as the following: illness, moving away, needed at home, marriage, not enough pay, dissatisfaction, cannot stand the strain, too far to come, better job elsewhere, and so on indefinitely. These and similar factors are beyond the control or domain of the employment psychologist. If an applicant who was successful in the tests leaves his work for one of the above reasons, it does not follow that the tests were at fault. On the other hand, if individuals who failed in the tests for a certain kind of work become successful workers nevertheless, it is an indication of at least three possibilities: First, the standard in the tests may be too high; secondly, the tests may be useless; thirdly, the individuals in question may possess other qualities which compensate for their inability in the tests, for instance, unusual ambition or a dire need for money. One of the most conspicuous examples of the third possibility arose in the course of an experiment carried on with inspectors. The experimenter was asked by the foreman to test a certain girl who had caused him considerable perplexity. This girl, the foreman stated, was an excellent worker in every way except ability to turn out a sufficient quantity of work. She was industrious, accurate, cheerful, and steady, but not productive. During the course of the psychological examination this inspector did very well in every test until she came to the last and most significant. In this test, her performance was far below the required standard, so far, in fact, that she would not have been hired for inspection work if she had applied after these tests were established. Nevertheless, this girl finally succeeded and became one of the best inspectors in the room. To be sure it took her two months to succeed whereas the ordinary girl requires only two weeks. However, her ambition and her other excellent moral qualities were such as to enable her in time to overcome the initial handicap with which she began.

10. *A Battery of Three Mechanical Ability Tests*

L. D. Anderson, "The Minnesota Mechanical Ability Tests," *Personnel Journal*, 6:473-478 (1928); reprinted by permission of Williams & Wilkins Co.

It is the purpose of this article to describe three tests, which have been made highly reliable and which have a good, an already demonstrated, and a statistically sound validity. It is felt that these tests will be of advantage to industry in that they will give to the industrial psychologist a reliable means of measuring mechanical ability. . . . The research staff worked with two purposes

in mind: to develop tests with a high degree of reliability, i.e., tests which would give essentially the same scores for an individual if he were re-tested; and to demonstrate how accurately these tests would give an index of an individual's mechanical ability in an experimental situation.

No mention will be made here of the techniques used or specific results secured, except to state that every effort was put forth to make each of the tests reliable by (1) adding items, (2) changing time limits, (3) revising directions and (4) re-ordering the items within a particular test. In order to measure validity the test scores were checked against a school criterion of mechanical shop success. This criterion was both reliable and objective. It was independent of teacher ratings. The tests were found to give as high predictions of mechanical shop success as those given by intelligence tests in measuring academic success. . . .

The Minnesota Assembly Test.—The test that has probably been used most frequently as a test of mechanical ability in the past decade is the Stenquist Assembly Test, developed by John L. Stenquist about 1914. This test was used widely during the World War as an index of an individual's mechanical aptitude. This pioneer attempt to devise a suitable test of mechanical ability resulted in a measure which gave good results in many situations, and at the time of its compilation had a good reliability. Since the original test does not approach the standards set up in other fields in reliability or consistency, a revision was made. That the two tests might be distinguished readily, the new form was called the Minnesota Assembly Test. In brief, this test consists of a number of mechanical devices which have been taken apart; the subject is instructed to assemble the parts of each device, and the accuracy with which he does this is an index of his mechanical ability.

The original Stenquist Test consisted of ten items. Since reliability is dependent in a large measure on the length of the test when suitability, objectivity, etc., have been taken into account, we added twenty-four to the original ten and made substitutions in two cases where the article in the Stenquist series could not be secured. This gave us a test of thirty-six items as follows:

Box A

Item		*Item*	
1.	**Expansion nut**	6.	**Bottle stopper**
2.	**Hose pinch clamp**	7.	**Push button door bell**
3.	**Hunt paper clip**	8.	**Bicycle bell**
4.	**Wooden pinch clothes pin**	9.	**Corbin rim lock**
5.	**Links of chain (6)**	10.	**Coin purse**

Box B

Item
1. Safety razor
2. Monkey wrench
3. Ring stand clamp
4. Test-tube holder
5. Spark plug

Item

6. Inside calipers
7. Electric plug and wire
8. Clover leaf coin purse
9. Flatiron handle
10. Mouse trap

Box C

Item
1. Hæmeostat
2. Die holder
3. Pliers
4. Electric light socket
5. Wing nut
6. Glass drawer knob
7. Rope coupling
8. Kettle cover knob

Item

9. Lock nut
10. Fork magneto-post
11. Petcock
12. Hose clamp
13. Radio switch
14. Pencil sharpener
15. Air gauge valve
16. Metal pencil

In the selection of the added items, care was taken to include items which would give a range wider in difficulty. Through this precaution the test was made more suitable for both younger and older subjects than the original test. . . .

The Paper Formboard Test.—Test 7 of the Army Group Examination Beta, Form O, for use with illiterates, is similar in plan to the usual formboards. In each item there is a large figure and two or more smaller ones, which are segments of the large one. The subject indicates by drawing lines in the large figure how the small ones could be fitted into it. This test formed the basis for the Minnesota Paper Formboard tests, Series A and B. Two four-page blanks were constructed consisting of 56 items each, the items being arranged in order of difficulty.

This test has a high reliability, 0.90, and gave the same index of efficiency in the prediction of shop success as the Minnesota Assembly Test. The Paper Formboard requires fifteen minutes for each series, and is scored by the use of stencils.

The Spatial Relations Test.—Dr. H. C. Link, while connected with the Winchester Arms Company, devised a formboard test which had two advantages. The test consisted of two cut-out boards and one set of blocks. The blocks were placed in one board by the examiner and the board turned over on the table so that the blocks fell out. The subject then placed the blocks in the second board, the advantage here being that the location of the blocks on the table was the same for all subjects. The second advantage lay in the fact that the test combined discrimination of

both form and size. For each form in the boards there were three different sizes of blocks. Thus, it was necessary for the subjects to make their judgments on the form of the block as well as on its size.

This test, however, is not long enough to give a high reliability. In the Minnesota revision two parts of the boards were made, each containing fifty-four cut-outs. The principle of inverting the board in order to secure a standard arrangement of blocks was discarded and in its place was substituted the practice of using boards with no back base. When the board is lifted from the table the blocks fall through the cut-outs onto the table. This method has an advantage over the Link method, since it does not invert the position of the blocks. This test has the lowest reliability of the three tests here described, but has approximately the same validity.

The fact that these tests have the same validity as measured by correlation coefficients does not mean that they are measuring the same ability. The lowness of the intercorrelations of the test scores indicates that the tests are measuring different aspects of the ability which we designate roughly as mechanical ability. The existence of low intercorrelations indicates, that by combining the tests into a battery by multiplying the scores of each test by constant weights and adding the results for each individual a higher validity coefficient may result. In the work at Minnesota this was done, and it was found that the prediction of the battery was considerably greater than that of any single test.

Validity of the Battery of Tests.—In order to determine the predictive power of these tests when used together as a battery, the scores in shop success were divided into six classifications and labelled A, B, C, D, E, and F; A being a high and F a low score. The test battery scores were treated in the same manner. Upon analysis the following results were obtained:

1. Fifty per cent of the cases were located exactly, that is, the boys with test scores of A received shop success rankings of A, the boys with test scores of B received shop scores of B, etc.

2. Forty-five per cent of the cases were located one position away from absolute accurate position, that is, the boys with test scores of A received shop success scores of B, the boys with test scores of B received shop scores of either A or C, and the boys with test scores of C received shop scores of either B or D.

3. Five per cent, or the remaining cases, were located two positions away from absolute position, that is, the boys with test scores of C received shop scores of either A or E, and so on.

11. *Measured Mechanical Ability*

D. PATTERSON, R. ELLIOTT, L. ANDERSON, H. TOOPS and E. HEIDBREDER, *Minnesota Mechanical Ability Tests*, 298-302 (University of Minnesota Press, 1930)

Concerning mechanical ability, defined as whatever is measured by the tests and teams of tests developed in this experiment, the following statements may be made:

1. Several separate tests were developed which, from the standpoint both of reliability and validity, constitute adequate measures of mechanical ability. . . .

The Minnesota Paper Form Board, Spatial Relations, and Assembly tests proved very successful according to the more elaborately worked-out criterion scores of the experiment proper as shown above. The Packing Blocks and Card Sorting tests, however, did not give satisfactory validity coefficients. Likewise, the Stenquist Picture tests did not give high enough correlations with the criteria to warrant their use unless combined with other tests to form batteries.

2. One of the aims dominating the research at the outset, namely, the substitution of group paper and pencil tests for individual tests wherever possible, failed of realization. In view of the large number and great variety of tests tried out in the preliminary experiment, it is perhaps significant that tests suitable for the group testing by paper tests of mechanical ability are conspicuously absent. The net result is only one such test—the Paper Form Board test—and this test itself is subject to the criticism that it is not as unique with respect to intelligence as are the other two surviving tests—Minnesota Assembly and Spatial Relations.

3. Several additional measures proved diagnostic of mechanical ability including Hubbard's Interest Analysis, which has an odd-even Spearman-Brown reliability coefficient of +.87 and gives correlations of +.55 and +.39 with the quality and information criteria, respectively. Others showing sufficient correlation with the quality criterion to warrant inclusion in the main test batteries are: right hand dynamometer, son's mechanical operations, Stenquist Picture II, and academic grades.

4. Using the multiple-ratio technique batteries of tests were selected for particular purposes. The best possible battery correlated +.81 with the quality-information criterion. Correlations between several batteries and the quality criterion ranged from +.55 to +.73. It will be noted that these validity coefficients compare favorably with those of standard intelligence tests. By means of the data on the separate tests (tables of intercorrelations,

criterion correlations, means, sigmas, and reliability coefficients) and the multiple-ratio technique, additional batteries may be constructed for specific purposes not considered in this study.

5. Analysis of the organization of mechanical ability indicates that it probably does not involve any single general factor. Low intercorrelations between different measures of mechanical ability suggest that factors of high specificity play a major rôle. More elaborate analysis failed to discover a comprehensive hierarchy of any sort, but revealed seven perfect hierarchies of four tests each, indicating that quasi-general or group factors may be involved, but giving no indication of their concrete content. Evidence derived in another connection showing that the tests do not behave consistently with respect to differences between the sexes or between vocationally differentiated groups constitutes supporting evidence for the theory of quasi-general factors.

6. Mechanical ability, as measured by the performance batteries, was found to be unique with respect to intelligence and also with respect to motor agility, when the factors of age and weight, which are positively correlated with motor agility, are held constant. Thus three measures of ability utilized in this research—mechanical ability, motor ability, and intelligence—fulfil reasonably well the requirements of unique traits.

7. No close correspondence was found between mechanical ability and environmental conditions. The results indicate that two aspects of the environment were measured, an economic-cultural aspect and a mechanical aspect, but there is little evidence that mechanical ability is more closely related to one than to the other, or that it is very closely related to either. The failure of this attempt to discover environmental factors responsible for the undoubted individual differences in mechanical ability exhibited by these seventh grade boys places the burden of proof upon the person who rejects the hypothesis that these individual differences are in large part innate.

8. A study of group differences indicates several facts about the distribution of mechanical ability in the population. There is a fairly regular increase in mechanical ability scores between the ages of eleven and twenty. However, the age groups are representative of boys in school at those ages and do not constitute a random sampling of the total population. A similar increase in mechanical ability scores as higher academic grades are reached was found, though the correspondence with academic grade status is not so close as that with age. Certain sex differences also exist which, when analyzed, reveal that boys are superior to girls only when a test (such as the Minnesota Assembly Test) registers to a

great extent the effects of previous practice in manipulating mechanisms. When such practice effects fail to influence test performance, the differences between the sexes tend to disappear. Similarly, vocational school boys and engineering students are not superior to academic students in mechanical ability, a fact that suggests that selection for vocational training is based on something other than possession of mechanical ability. Should more extensive experimentation with these tests in vocational schools and industry establish their validity for specific training and employment purposes, then society is faced with a new opportunity for the direction and utilization of human abilities. And what is more important, a method of attaining this objective in the interests of the individual and of society is available for use by educators and employers. The conservation and effective use of human talents is brought a step nearer.

12. *Sample Oral Trade Test*

J. C. CHAPMAN, *Trade Tests*, 138-140 (Holt, 1921)

MACHINIST AND MECHANIC: DIE SINKER

Score

1. Q. What will happen to the dies if they are overheated and cooled too quickly?
   A. Crack (break) — 4

2. Q. With what are die blanks colored for laying out work?
   A. Copper sulphate (blue vitriol) (blue stone) (Copperas) — 4

3. Q. What can be done if a die is accidentally cut too deep?
   A. Plane off (cut off) — 4

4. Q. What machine is used for sinking dies of irregular shape?
   A. Milling (die sinking) (profiler) — 4

5. Q. What is the ordinary draft given?
   A. 7 — 4

6. Q. Where is the edger located on a die?
   A. Side — 4

7. Q. What machine is used for cutting a straight groove between two deep holes?
   A. Shaper — 4

			Score
8.	Q.	What is used on a type to see if it is bedded?	
	A.	Blue	4
9.	Q.	What is the waste metal called that is formed around the forging?	
	A.	Flash	4
10.	Q.	What is the end of the forging called where it is joined to the Stock?	
	A.	(1) Gate	4
		(2) Sprue	4
11.	Q.	What is a small curved file called?	
	A.	Riffler	4
12.	Q.	How much per inch should the shrinkage allowance be between a drop forging and the die for trimming the forging cold?	
	A.	(1) .012 to .200	4
		(2) $\frac{1}{64}$ to $\frac{3}{16}$	4
13.	Q.	What is the usual finish allowance on a drop forging?	
	A.	$\frac{3}{32}$ to $\frac{1}{8}$ of an inch	4
14.	Q.	What is the impression in the die called which is used just before the finishing impression?	
	A.	Blanking (blocking) (roughing)	4
15.	Q.	How is the die laid out so that the finished forging will be the right size?	
	A.	Shrinkage	4
16.	Q.	What form of a die is used for removing the flash?	
	A.	Trimming	4
17.	Q.	In making a forging with a large hump on one side why is the deepest impression in the top die?	
	A.	(1) Forms up better than down (fills top easier)	4
		(2) Keeps free from scale	4
18.	Q.	How is a die cut so that the forging will not stick?	
	A.	Draft	4
19.	Q.	What is used for packing die blocks when carbonizing?	
	A.	(1) Bone-dust	4
		(2) Charred leather	4
		(3) Charcoal	4

20. Q. What carbon steel is used for trimming dies? *Score*
A. 60 to 90 4

RATING THE CANDIDATE

Score	*Rating*
18 and below	N
19 and 20	A —
21 to 47 inclusive	A
48 and 49	A +
50 and 51	J —
52 to 69 inclusive	J
70 and 71	J +
72 and above	E

There is no E — or E + rating

[These letters have the following significance:
N—novice, or a perfectly "green" hand
A—apprentice, or one familiar with some of the obvious or simpler items
J—journeyman, or one with creditable skill in this field
E—expert, or master workman]

13. *A Standardized Test for Office Clerks*

L. L. THURSTONE, "A Standardized Tests for Office Clerks," *Journal of Applied Psychology*, 3:248-251 (1919)

The clerical examination here reported has been taken by about five thousand office clerks and has been standardized by the Phoenix Mutual Life Insurance Co., the Equitable Life Assurance Society, the Westinghouse Electric & Mfg. Co., the Bell Telephone Co., Western Electric Co., Strawbridge & Clothier, Armstrong Cork Co., and others.

In devising a vocational test the psychologist should be guided by three fundamental considerations affecting the content of the test. (1) the difficulty of the content should correspond to the intelligence level of acceptable candidates. (2) The content should have an interest appeal to candidates who would be interested in the work tested for. (3) The special abilities should be represented in the test if there are any demonstrable special abilities. I do not believe that office work has any special abilities that have so far been demonstrated and hence I have confined myself to the first two criteria; namely, an appropriate intelligence level and content that appeals to the applicant for an office position. This reduces itself to the same type of problem that we find so frequently in

preparing vocational tests; namely, the preparation of an intelligence test out of relevant content.

In deciding on the length of a vocational test we may be guided by two diametrically opposed considerations. If we have in mind the convenience of the interviewer or examiner in the employment office we should be tempted to use a short ten-minute test. So many distracting influences may appear in ten minutes and so much depends on the candidates "warming up" to the test that I should hesitate rejecting an applicant on what he does in a ten-minute interval. However, a ten-minute test is diagnostically more valuable than a ten-minute interview and if the two are combined, so much the better. The opposite consideration is that if no test is given, the applicant is put to work under more or less informal observation, and if the supervision is at all adequate it will appear during the course of a week or two whether the new employee is unusually capable. But two or three weeks represent many hours, not minutes. Now, why should we not give the employee a *standardized sample office job* which requires about 45 to 60 minutes? By means of a sample office job which has been standardized we may know more about the candidate's capacity for a variety of office jobs than can possibly be judged from a short list of opposites or other brief general intelligence test. These are some of the assumptions on which the clerical examination was devised.

The following is a brief description of the eight parts of the examination:

A. In this part the candidate checks the errors in addition and subtraction. There are only a few errors on the page of 120 additions. The small number of errors is intended to duplicate actual office conditions in which errors are even at worst more infrequent than correct answers. The careless candidate sees so many of the additions correctly performed that he does not scrutinize each item sufficiently to discover the errors.

B. In this part the candidate reads a section of Arnold Bennett's "Mental Efficiency" in which about forty of the words are incorrectly spelled. He is instructed to underscore every word that is incorrectly spelled, but the careless candidate becomes interested in the content and forgets to look for spelling, a condition which is typical in many office situations.

C. In this part of the examination the candidate cancels the four letters, X, Z, U, and C. This combination of letters is rather difficult to keep in mind and taxes the attention of the candidate.

D. This is a short code learning test in which the systematic worker can profit from attending to the task in hand and thereby

soon learning the letter-digit combinations. By doing so he gains time.

E. This is an alphabetizing test in which the candidate writes a list of forty names, placing each name in one of ten spaces and alphabetizing each of the ten groups of names. This test shows not only handwriting but affords a good opportunity for systematizing a simple clerical job, since the candidate can choose many different methods of doing the task.

F. This is also a test in which the candidate can profit by planning the task. He is expected to designate a list of insurance policies in three classes, according to the kind of policy, the date of issue, and the amount. He must keep these three attributes of the policies in mind simultaneously or so arrange his task that he can deal with each attribute separately. The method of performing the classification is necessarily chosen by the applicant.

G. The Clerical Examination would not be complete without an arithmetic test. This part of the test contains twelve simple problems in arithmetic, including addition, subtraction, multiplication, fractions, and percentage.

H. The last part of the Clerical Examination is a bona fide general intelligence test and consists in matching ten proverbs with ten other proverbs so that the two proverbs in each pair have the same meaning or moral.

The Clerical Examination is given as an omnibus test with a maximum time limit of 90 minutes for the whole pamphlet. The average time is approximately 40 minutes. The instructions to the examiner are as follows:

> Give the applicant a copy of the Clerical Examination and ask him to do what it tells him to do. Select for him a quiet table where he may work without being disturbed. Record on the cover of the applicant's paper the "Starting Time." Tell him to return the blank to you or your assistant when he has finished. When the applicant returns the papers, record his "Finishing Time."

I have found it convenient to eliminate the test proper from the first page of mental test blanks. The test proper is begun after the candidate turns the title page. This feature gives the examiner better control over the time, which is especially important with tests of short duration. On the title page of the Clerical Examination I have arranged a boxed space for a complete record of performance so that the examiner has a definite square in which to record each of the various scores, times, and percentiles. The headings in the boxed space are Finishing Time, Starting Time, Total Time, Speed Rank, Test A, Test B, Test C, Test D, Test E,

Test F, Test G, Test H, Accuracy Score, Accuracy Rank, and Combined Rank.

When these pamphlets are filed with the employee's personnel records his performance in the Clerical Examination is easily referred to since it is summarized on the title page. The Accuracy Score is the sum of the scores allotted to each of the ten tests. The Accuracy Rank is the percentile rank of the Accuracy Score. The Speed Rank is the percentile rank of the Total Time.

Statistical Evaluation.—In order to ascertain the diagnostic value of the examination it was given to one hundred employees of a large insurance company ranging from minor executives to young office clerks doing routine work. The employees were rated in five classes according to the grade of office work in which they are employed. In addition to this information the age and schooling of each candidate was ascertained for correlation purposes. The following results are quite interesting.

Grade of office work actually being done by the candidate correlates with:

Accuracy in test	r	+.50
Speed in test	r	+.42
Schooling	r	+.47
Age	r	+.35

By multiple correlation the following coefficients have been ascertained between the grade of office work being done by the candidate and:

Accuracy and Speed combined	r	+.61
Schooling and Age combined	r	+.52
Accuracy, Speed, Schooling	r	+.64
Accuracy, Speed, Schooling, Age	r	+.67

It is significant, as shown by these correlation coefficients, that speed and accuracy in the Clerical Examination give a more reliable prediction of ability in office work than age and schooling combined.

In evaluating speed and accuracy by the method of multiple correlation it so happens that the two regression coefficients are alike, which means that in the combined score each minute of time is equal in weight to one of the 100 points of accuracy. This fortunate coincidence facilitates the determination of a combined score which represents both speed and accuracy.

14. *A Typical Testing Program*

H. C. LINK, *Employment Psychology* (modified), 23-35
(The Macmillan Co., 1919)

The general purpose of the experiment was to guide the employment office in selecting new candidates. The more specific purpose

was to discover a set of tests in which the performance of the girls would correspond with their daily *production* or *output* of shells. If it could be demonstrated that the best workers did best in certain tests, and that the poorest workers did the poorest in these tests, then it would be reasonable to assume, subject to further proof or disproof, that these tests gave a reliable indication of the workers' ability at inspection. Only those applicants who showed a certain degree of skill in these tests would be selected for the type of work on which these tests had been found significant.

The next step was to make a careful and intensive study of the qualifications involved in doing the work of inspecting shells. Each shell had to be closely scrutinized on both its inner and outer surfaces for scratches, oil dents, stains, and other defects. An analysis of this operation showed that it required the following qualifications:

1. Good eyesight
2. Keen visual discrimination
3. Quick reaction
4. Accuracy of movement
5. Steadiness of attention

This analysis having been made, the next step was to find tests which would be likely to detect the presence of these qualities. Eight tests were chosen as follows:

1. Simple eyesight test (Lowell chart)
2. Card-sorting test (sorting cards bearing *O*'s)
3. Woodworth-Wells cancellation test (for numbers)
4. Woodworth-Wells "Easy-Directions" test
5. Woodworth-Wells number-checking test (combinations)
6. Tapping test (telegraphic modification)
7. Whipple accuracy test (modified)
8. Whipple steadiness test (modified)

After the average hourly production of each girl for a period of four weeks had been determined, the results were compared with the performance of each girl in each of the tests. This was done to obtain the degree of correspondence or the *correlation* as it is technically called, between the tests and the actual production. The following table of correlations was obtained:

Test	Correlation
Card sorting	.56
Tapping	.14
Cancellation	.63
Easy directions	.14
Number group directions	.72
Accuracy	.38
Steadiness	.24

Because of the nature of the eye test, only individual correspondences could be shown. It was plainly evident, however, that an inspector needed two very good eyes in order to succeed at this work.

It can be seen that three tests show a correlation which is really significant. Two of these show a correlation of over .60 which is very good and one shows a correlation of .56 which is also quite good.

The significance of these correlations will be more apparent if we compare them with those brought out by another section of this experiment. Besides giving the tests to girls engaged in visual inspection, the same tests were given to 21 girls engaged in gauging the head-thickness of shells. This work does not require the use of the eyes. . . . The operator sits in front of her gauge which is rigidly fixed, and tries each shell at one opening and then at another just as rapidly as she can move her hands up and down. It will readily be seen that this work requires qualities quite different from those required by the girls engaged in the work of inspecting. This difference was admirably brought out by the tests. The tests showed, in this instance, an entirely different set of correlations. The correlations found in both instances are given below.

Tests	Correlations	
	Inspectors	Gaugers
Card sorting	.55	.05
Tapping	.14	.52
Cancellation	.63	.17
General intelligence.......	.14	.18
Number group checking...	.72	—.19

It so happens that the very test which shows the highest correlation among inspectors shows the lowest correlation, a minus correlation, in fact, among the gaugers. This is quite in accordance with the apparent fact that for the work of inspection visual discrimination is probably the quality least necessary. An interesting fact was the absence of correlation between the test for intelligence, involving the ability to read and follow easy directions, and the work of both inspecting and gauging. This indicated that intelligence of this kind was not necessary for success at such work and this, so far as ordinary observation could tell, was quite true. The only test which shows a significant correlation among gaugers is the tapping test. This seems reasonable, since, in both the test and the operation of gauging, speed of movement and endurance

are the chief factors. The significance of this part of the experiment is therefore chiefly negative since it serves to bring out the fact that girls, who, to the ordinary observer and even to the trained employment manager, look very much alike may still possess very different sets of qualifications. If all the gaugers and inspectors had been lined up before the employment window, it is highly improbable that the employment manager would have been able by mere observation to make the radical division between the applicants which the tests would have enabled him to make.

C. Limitations of a Testing Program

15. *Predictive Value of First Efforts*

G. W. HARTMANN, "Initial Performance as a Basis for Predicting Ultimate Achievement," *School and Society*, 29:495-496 (1929)

From the behavior of a subject in the beginning stages of the learning process can one foretell with any confidence his relative standing in the later phases? Where a new act is to be mastered, is it possible to detect the eventually competent person at the outset as well as at the finish? This question is often answered in the affirmative by industrial and educational executives, and many of our practical judgments on individual ability postulate the correctness of such a view.

Recent work in mental testing, however, suggests that initial accomplishment is disproportionately affected by chance variables and that an adequate measure of skill can be derived only from a prolonged series of measurements. Hence, most experimenters permit a few preparatory trials before taking any critical records.

It was thought possible to approach this problem in at least one narrow function by an adaptation of a suggestive device first used in a different connection by Bair. The material is designed primarily to measure the speed of verbalization in the following four aspects: (1) the repetition of the alphabet as rapidly as possible *forward*, i.e., A-B-C; (2) the interception of the letter "n" between each pair of the letters, i.e., $A_nB_nC_n$; (3) the repetition of the alphabet as rapidly as possible *backward*, i.e., Z-Y-X; and (4) the repetition of the alphabet backward intercepting "n" between each pair of the letters, i.e., $Z_nY_nX_n$.

The data were obtained from fifty members of a class in educational psychology by means of an individual experiment ostensibly designed for the analysis of practice curves. The students worked in pairs, one partner giving directions to the other and measuring the time for each repetition in *seconds*. Twenty trials were made

of each of the four series listed above, records being taken *twice daily*. The high reliability of the measures (see Table II) argues against the presence of any motives inimical to objectivity.

The data were first treated by finding the total average time in seconds for all twenty trials in each series; the initial average time from the first *three* trials, and the final average time for the last three trials. (Throughout this discussion the number of each series corresponds to the order above described.) The next step consisted in finding the correlation between the initial and final averages in every series with the results shown in Table I.

TABLE I

Series	Pearson r Between Initial and Final Means	Probable Error (N = 50)
I	.78	.03
II	.43	.08
III	.64	.05
IV	.56	.06

The average correlation here is approximately .60, which, to the writer at least, is surprisingly high. On the strength of these values it would appear that even in such a restricted capacity as reversed alphabetization most subjects adhere to the level of achievement they have struck at the start.

If, as seems likely, the man who is excellent at the beginning of practice will be good at the end, and *pari passu* for the poor subject, we are naturally led to inquire if the competent subject in one series will also distinguish himself in the others. A solution to this subsidiary problem may be sought in the intercorrelations of the total averages for the four distinct learning processes.

TABLE II

Series	I	II	III	IV
I	*.91 (.02)* *			
II	.76 (.04)	*.86 (.03)*		
III	.30 (.09)	.43 (.08)	*.99 (.005)*	
IV	.36 (.08)	.50 (.07)	.93 (.01)	*.97 (.009)*

*Probable errors in parentheses. N = 50.

The figures lying along the italicized diagonal indicate the reliability of each series obtained by matching the measures of the

odd and the even trials. It will be observed that the intercorrelations are all moderately positive and that the greater the degree of external similarity between any two series the greater will be their intercorrelation; e.g., series III (saying Z-Y-X) is concomitant to the extent of .93 with series IV (saying $Z_nY_nX_n$). One may interpret this as attributable to the high degree of overlap between the different neuromuscular patterns involved, or as evidence for the action of a general factor, according to one's theoretical predilections.

Another question which might be raised in this connection would be: Do the initial or final intercorrelations deviate more from the total average correlations of Table II? The logic demanded in answering this is simple enough, although the calculations are laborious. Table III gives the necessary information. (The *first* decimals represent the *initial intercorrelations* and the *ones in parentheses* stand for the *final intercorrelations.* P.E. values are omitted, but may readily be estimated from preceding figures.)

TABLE III *

Series	I	II	III	IV
I	.....			
II	.31 (.53)	......		
III	.16 (.38)	.67 (.45)	......	
IV	.03 (.42)	.44 (.52)	.83 (.92)	......

* N = 50.

In all but one case the final intercorrelations are higher than the initial. To find which deviated more from the total average intercorrelations, the algebraic mean differences in points between it and the initial and final intercorrelations were obtained for each series. The mean differences are .22 and .07, respectively, showing that the final intercorrelations approach more closely the values of the total average intercorrelations.

It is of some interest to note how this investigation confirms a conclusion earlier reached by Hollingworth to the effect that "the intercorrelation coefficients become greater the longer the practice is continued." Another dictum of modern psychology here illustrated is best expressed by a quotation from a related experiment of Wells.

A high initial efficiency may carry with it as much or more prospect of improvement under special practice than a low one. It is not because the favored individual has had more of the general experience enabling

him to meet the experimental situation better, but because he possessed the native ability to profit more by such experience, general or special, past or future. Not practice, but *practiceability,* is responsible for the superior position of such an individual; and in broader aspect, not education, but educability.

16. *A Fundamental Criticism of Mental Tests*

B. KERN, *Wirkungsformen der Uebung,* 463-472, freely translated (Helios Verlag, Muenster, 1930)

The problem of the relative stability of initial test scores may be answered on the basis of our experiments as follows: *The achievement values attained after one practice trial are not stable.* In most of the tests the correlations between the ranks at the beginning of the practice session and those reached after several weeks' work when the relative positions of the subjects were fairly fixed are very poor. The graphic profile curves simply confirm the unsuitablity of the initial series for prognostic purposes.

It is apparent that only one application of an aptitude test leads to gross errors in many individual cases. We have no assurance that those subjects whom the test indicates to be highly competent will not suffer a marked decline in accomplishment after repeated trials, and cannot be certain that those subjects whom the test reveals as incapable will not surprise us by suddenly leading the group.

The most probable explanation for this inconstancy in the serial order is the presence of varying degrees of inhibition at the start which act independently of the individual's level of talent. *It is only after these initial inhibitions have been overcome that a prognostic value appears in the test scores.* With simple tasks this permanence of order occurs within a few days, but with more complex functions it may take weeks.

These results affect seriously the validity of the psychotechnologist's measures. It is true that when good and poor groups are formed on the basis of initial scores only, the "good" group contains more of those who will ultimately clinch their right to be termed good, and their average level of performance is unquestionably higher. Perhaps it is this elimination of the grossly unadapted which constituted the chief advantage of the tests in the eyes of the employer who remarked: "If you psychologists are successful in discovering only 10 per cent of the unfit among the applicants, then these tests more than pay for themselves."

However, a testing instrument which can only identify the extremes of ability is gravely deficient from the standpoint of the

workmen, regardless of its value to the employer. He needs an exact estimate of his fitness and this the customary testing procedure cannot give him. Initial test scores may, and as a matter of fact do, offer a useful basis of prediction for *groups,* but they fail to give a trustworthy foundation for *individual* prognosis.

It should be noted that the main reason for this inadequate prognosis is the failure to institute control and practice experiments. If the testing operation is prolonged beyond the beginning stage and carried to a critical point in the practice curve (which point varies with different tests and must be empirically determined for each), then in all cases absolute stability of position ensues. Only then do the measures have the predictive value which has wrongly been attributed to them on the basis of a single test period.

17. *Mental Measurement Plus Clinical Analysis*

M. S. VITELES, "The Clinical Viewpoint in Vocational Selection," *Journal of Applied Psychology,* 9: 134-137 (1925)

"Many psychologists," as Maxfield wisely observes, "have had the tendency to confuse mental measurement with analysis and mental interpretation." In vocational selection in industry this has especially been the case. Statistics and the statistical point of view have dominated. It is the opinion of the writer that in the cause of greater scientific accuracy in vocational selection in industry the statistical point of view must be supplemented by a clinical point of view. It must be recognized that the competency of the applicant for a great many jobs in industry, perhaps even for a majority of them, cannot be observed from an objective score any more than the ability of a child to profit from one or another kind of educational treatment can be observed from such a score. There is no reason for suspecting that the capacity of an individual motorman to avoid accidents, or of a printer's apprentice to profit from instruction in this trade can be expressed in an objective score, as easily interpreted by a minor clerk as by a trained psychologist, than for suspecting that the mental status of a child is revealed in the I.Q. which can be obtained by any teacher who owns a copy of Terman's Condensed Guide and a set of testing material. The one problem is as complicated as the other; the objective score in one case has in it as many elements of error as in the other, and an adequate diagnosis in both involves interpretation by a trained psychologist based on observation of performance and a consideration of related data. . . .

Industry should be told quite frankly that there are some jobs for which workers can be satisfactorily selected by means of tests

graded and statistically evaluated by minor clerks in the employment office. The specific jobs for which this holds true are determined in part by the duties of the job, the universality and what might be termed the superficiality of the qualities needed for success in the job, and by certain economic factors such as cost of labor turn-over, the relative turn-over of the total group employed in this type of work, the time and cost of training, etc. But industry must also be told with equal frankness that there are a great many jobs for which workers cannot be adequately selected by tests administered and interpreted by employment clerks. It must be told that the selection of applicants for such jobs involves an examination by a trained psychologist who depends upon his scientific knowledge of human behavior as well as upon the test results. Industry must be told that the immediate cost of such a procedure may be great, but that ultimate economy is implied in the acceptance of such a procedure.

An assumption which is perhaps not recognized by a great many workers in this field, is that of the relative unimportance of the individual worker in industry. A selective process which is satisfied with the probable adequate selection of a group of workers, rather than with the proper placement of the individual worker (and such is the case in selection based upon objective scores alone) fails to give adequate consideration to the well-being and interest of the individual worker, an interest which in comparison with the point of view of European psychologists, has been shamefully neglected by the American psychologist. . . .

A discussion such as this of the clinical viewpoint in industrial selection involves a reconsideration of the place of the psychologist in industry. The acceptance of the statistical viewpoint makes place in industry for what has been called a psycho-technician, a worker with a minimum training in psychology and a maximum training in statistics. He is a technician in the fullest sense of the word, well trained in method, but not in theory. He understands the various steps to be taken in standardizing a test and in statistically treating the results for the revelation of significant scores. In many cases he need know little about mental tests, since statistical treatment will reveal the significant ones, although a little information about tests may be helpful in providing short-cuts in the determination of the significant ones. Of clinical observation and interpretation of performance he need know nothing at all, and generally knows nothing. He is a consultant in industry, supervising the construction and statistical evaluation of tests and the administration of such tests by a polite, but not necessarily intelligent, clerk.

If the clinical point of view is to affect vocational selection the worker must be more than a psycho-technician. He must be a psychologist trained in psychological theory and methods as well as in statistics. He must be more than a consultant; he must be a co-worker in the personnel department, imbued through experience and study with an understanding of the selection problems of the particular plant and with the problems of the job for which he is testing. He must function in the examination of the applicant, applying his experience in the observation and analysis of performance in deciding whether a given applicant should be employed. He becomes in a sense a sort of superior employment officer, weighing the test score, his observation and analysis of performance with other essential data about the applicant in determining whether or not the application is competent for the job. His judgment is a diagnosis, as that of a physician, based upon a consideration of all the data affecting success or failure on the job. . . .

This does not mean that there remains in industry no place for what has been called the psycho-technician in industry He has exactly the same place in industry as the laboratory technician has in medicine. He is the assistant to a trained examiner, providing such objective quantitative data as he can for interpretation by the trained examiner. In certain cases, as has been indicated, he may even be the sole representative of psychology in industry, functioning in the standardization of tests and in the determination of a set of statistical values useful in employing a particular test in selection. Such a job a psycho-technician can very well do, but his services should be provided with the understanding that industry is receiving not psychological services, but technical services; that it is using in employment not necessarily psychology but statistics slightly diluted with a smattering of psychology. Such services should not be sold under false pretenses, as has often been the case.

QUESTIONS

1. Can you discriminate between a test of "capacity" and a test of "ability"? When would you use one rather than the other?
2. Does the fact that mental tests measure only a fraction of a person's powers make it necessary to reject them? Why?
3. How does an "empirical" test differ from an "analogous" test? Describe the procedures involved in using each.
4. What are the possibilities and limitations of persons of subnormal intelligence in industry?
5. Name specifically some of the contributions of clinical psychology to a personnel program.

6. What are the major varieties of trade test, classified as to *form* and not as to occupation?
7. Does modern business organization make sufficient use of the facts of individual differences? Indicate instances where it does and cases where it does not. Would you extend this sphere of application or would you restrict it?

CHAPTER VII

ANALYSIS OF OCCUPATIONAL INTERESTS

Interest in a task lends zest to its performance; lack of interest makes the job an onerous duty. It often seems that the uninteresting chores in the world outweigh the attractive ones, but that may largely be due to the fact that all too many persons are occupying the wrong niches in life. Since so many human values hinge upon the presence or absence of interest, the importance of this factor in producing the best adjustment of the worker to his work must be obvious.

Interest and ability are positively allied. A man who enjoys swimming is probably one who can swim relatively better than he can do other things; conversely, the student who is weak in mathematics is apt to dislike it. Whether interest generates ability, whether ability gives rise to interest, or whether both are common outcomes of some third unknown factor, remains unknown at present. Interests appear to be more flexible than abilities but, even so, studies indicate a surprising stability of interests throughout life. The boy foreshadows the man in both competence and liking for specific things.

Interests are commonly divided into intrinsic and extrinsic. Most persons have an intrinsic interest in watching the printing press (witness the crowds that gather outside the windows of a newspaper plant!); if a stockholder of the company is in the crowd he will very likely have an extrinsic interest because some of his capital is invested in that bit of machinery. Relatively few things in this world are intrinsically (or originally) interesting, but most of them can acquire an extrinsic (or derived) interest by virtue of association with things which are natively satisfying; e.g., a workman may not take delight initially in clean tools and bench, but if his boss praises him therefor, the satisfaction which the approval elicited will transfer to the work which occasioned it. So likewise an engineer may study mathematics at first only because it is indispensable to his life ambitions, but if he pursues the subject far enough he may

become so fascinated thereby as to study it for its own sake. What was once secondary has now become primary.

To analyze and measure complex tendencies such as interests is difficult. The need, however, for both qualitative and quantitative classification of interests in the proper adjustment of an individual in his work has led to efforts that have yielded techniques for revealing interests. These studies are relatively few, having been made since 1920; but they may be illustrated well by samples from the field of engineering where they had their origin.

A. Discriminating Engineering Interests

1. *Pioneer Measurements of Occupational Interests*

B. V. Moore, "Personnel Selection of Graduate Engineers," *Psychological Monographs*, Vol. 30, Whole No. 138:34, 45, 47, 81 (1921)

Technical school grades, grades and ratings on the work of the men during training in the industrial organization, and the results of tests indicate that the engineer cannot be differentiated for the different kinds of work by general intelligence or mental alertness. Men with equal mental ability are found in all the lines of work. Success of a certain person in a particular line of work is evidently due to general intelligence or mental ability directed in a particular line of interests. However, it is probably true that the interests are based on a particular ability or group of abilities which makes activity and achievement in a particular line of work possible and interesting.

After the man has a definite strong interest in any line of work or activity, this interest, motivation, or whatever it may be, should be taken advantage of. It is difficult to discover just what the interests are, and often the graduate student engineers cannot decide themselves what work they would prefer. In order to make possible the planning and direction of their training, the custom has been to ask them to indicate their choice of work at the end of two months of work with the Westinghouse Company, during which time they have been doing various kinds of work in the shop under the supervision of the Educational Department. To help them make this choice, a combination of rating scale and test, entitled "Record of Interests," was prepared. . . .

The part of the "Record of Interests" which proved most significant was that section entitled "Choice of Other Occupations." After experimentation with a much larger list of occupations,

twenty occupations were chosen because they had given the best results for differentiating the engineers. The student engineers were directed to check ten of them with a plus, as the more desirable, and to check ten with a minus as the less desirable kinds of work. These appeared in the form as follows:

Choice of Other Occupations

Disregarding all your training and education and all differences in compensation and social standing of the following occupations, consider only your interest and satisfaction in working at each of the following occupations represented. Check with a (+) the ten kinds of work which you would most prefer to do; and check with a minus (—) the ten which you would dislike or least like to do.

( ) * Architect
( ) * Automobile repairman
( ) Automobile salesman
( ) Bank cashier
( ) * Carpenter
( ) * Draftsman
( ) Editor of popular magazine
( ) Hotel keeper or owner
( ) * U. S. Government astronomer
( ) Lawyer
( ) * Machinist
( ) Newspaper reporter
( ) * Pattern-maker
( ) Private secretary
( ) Purchasing agent
( ) Real estate agent
( ) * Research worker in physics
( ) Stockbroker
( ) * Toolmaker
( ) * Watchmaker

In the list as reproduced here, the occupations more often chosen by the design engineer or more purely engineer type of man are indicated by an asterisk. Of course, they were not so marked in the list presented to the men. The other occupations appeal to the sales type of man.

The relative percentage of the sales or engineering type of occupation chosen by a man indicated whether he was a sales type or an engineering type of man. To test the value of the Record of Interests, it was filled out by one hundred twenty-four insurance salesmen. Later it was filled out by thirty Westinghouse design engineers and thirty sales engineers, none of whom had been with the Company less than a year nor more than five years. The salesmen and the engineers showed a definite tendency to like or be interested in occupations which in nature of work were similar to those they were already following. The kind of occupations which they thought would give them the greatest satisfaction to follow was a significant criterion of the kind of work in which they could be and were already successful.

By computing for each engineer the percentage which his choices of occupations of a sales nature bore to his total number of choices,

a definite measure of his sales engineering interests as opposed to design engineering interest was obtained. It was assumed that if more than fifty per cent of a man's choices were occupations requiring a sales type of person for success in them, that man was a sales type of person; and if more than fifty per cent of the man's choices were occupations requiring a design engineering type of person, that man was a design engineering type of person. By this measure 78 per cent of the sales engineers were of a sales type; and 82 per cent of the design engineers were of an engineering type. Or assuming that we did not know the actual occupations of the engineers, those engineers which this test of interests alone would select for sales engineering, would be 89 per cent correctly placed or classified; and the man which this test of interest selected for design engineering would be 68 per cent correctly placed.

In conclusion, it may be stated that men in different lines of work have different interests. The interests of a person are not in just one specific occupation, but they are general to the extent that they pertain to very similar or closely allied occupations or activities. Interest in a certain class of activities is a criterion that the person will be interested in any other very similar activity. By similar activity is meant one that requires much the same information, training, experience, kind of materials and tools worked with, mental activity, personality, ideals of accuracy and perfection, and social attitude.

In the engineering profession, men cannot be differentiated for different lines of work by tests which measure what is commonly known as general intelligence or mental alertness. Men in the same kind of engineering work differ in this intelligence as greatly as men in different kinds of engineering work. The differences which fit these men for different kinds of work are something other than differences in intelligence. General intelligence as measured by a general intelligence test does show a significant positive correlation with the success of engineers in the same kind of work. One man differs from another in having special abilities, which, functioning in an integrated form as a kind of intelligence, can be measured and used as criteria for placing the man in the kind of work for which he is best fitted. The occupational interests of a man show a definite correlation with the kind of intelligence of special abilities which he has, and with the kind of occupation in which he is successful.

2. *Interview Method for Discovering Interests*

JOHN MILLS, "Engineering Aptitudes," *Journal of Personnel Research*, 3:198-202 (1924); reprinted by permission of Williams & Wilkins Co.

In the selection of a candidate for employment there are three questions to be answered: (1) along what lines of endeavor lie his fundamental interests and urges? (2) has he the technical foundation to produce in this line? and (3) has he the personality, character, and physical qualifications for such productive work?

The method to be described is concerned only with the answer to the first of these three questions. It is not a psychological test in the current use of that term. It is merely a program for the personal interview—a series of related questions which seem to uncover in the shortest time the basic urges of an applicant for employment.

When the line of interest has been established, the conversation with the candidate may be directed toward his classroom and technical activities, and a judgment formed as to his technical abilities. The school records and the faculty references supply further and accurate indications of his technical ability. During the conversation a judgment may be formed also as to the personality and character of the applicant and this may be further supplemented by personal references and records of accomplishments in the campus life of the institution.

To illustrate the method there will be presented in four parts, under headings A to D, an imaginary and one-sided conversation with a senior in a technical school.

A. *Media of Self-Expression.*—Now that you are finishing the formal part of your engineering training you will be looking for a job which will lead to an engineering career. You may start with a job, but if you are a man whom modern industry needs to cope with its growing complexity, both technical and economic, you should be qualified and capable of a real career. A career, whether for a member of the artistic or the engineering professions, is the expression of one's own personality working through some medium. An artist expresses his personality in the field of music through the medium of his voice or a mechanical instrument, or in the field of pictorial presentation through the medium of oils, water colors, or black and white. For the non-artistic professions there may be distinguished four media, namely:

1. Ideas 2. Men 3. Things 4. $ symbols

Of these two, men and things, are concrete; and the other two are abstract. To illustrate we may picture certain ideal and limit-

ing cases. The philosopher and the pure mathematician, for example, are concerned with the abstract field of ideas. The politician, the missionary, and the propagandist is each concerned with expressing his personality through swaying and influencing men. The statistical economist is a limiting example of a man interested in dealing with economic symbols of value. The machine operator in a highly standardized manufacturing process is an illustration of a man concerned entirely with things—with material productions. Usually, however, his choice has been limited by lack of education or personal ability and a better illustration might be found. Imagine a collector of minerals, an enthusiast who buys and trades to obtain new samples, who travels and explores, always in search of additions to his collection. And when they have been obtained he grinds, polishes, and mounts in his own workroom, and then labels and assembles, finding his greatest satisfaction in the handling of things. We all know the man who enjoys things to such an extent that he spends more time tuning up the engine of his motor boat or car than he does in operating it.

These are illustrations of extreme and limiting cases of interest in these four fields of self-expression. Most men have over-lapping interests. A good teacher is usually one who finds his field for self-expression in ideas and men. The men who started in the early nineteen hundreds the series of large corporations were probably expressing their personalities through the media of men and economic symbols. Now what is your own interpretation of your interests? Arrange these four media in the order of decreasing interest to you?

Usually the names of the four media were written out by the interviewer and the student assigned to them a numerical order. Replies are prompt and there is rarely any appreciable hesitation. The typical response is to indicate two of the four media as being important, and then to specify one of these as of primary importance, and finally to specify one of the remaining two as of slightly more importance than the other. No answers have yet been obtained where "$ symbols" appeared first. The other three are about equally favored for first choice by seniors in technical schools.

The next question to be described constitutes, as will be seen, a check on the first, and contributes some further detail. Only in rare instances did the two questions fail to check. In some of those instances further questioning developed what appeared to the interviewer as evidences of conflicts within the mind of the student, due to his having undertaken a course of training in engineering when his fundamental interests were in such a different professional line as ministry or medicine. . . .

B. *Interest in College Courses.*—There is another way of arriving at your interests and that is by considering your recent experiences in college. Suppose you classify the courses which you have been studying, and any work you have been doing, not according to the usual terms of so much mechanics, hydraulics, or electricity, but according to divisions which run across the courses of the curriculum. You might divide as follows:

1. Theory
2. Manipulation
3. Design
4. Methods of operation by human beings
5. Methods of operation by physical equipment
6. Engineering costs and economics
7. Artistic, literary, and non-professional interests

Now ask yourself in which division there is the most compelling interest. How would you arrange these seven divisions of your interest? Before you do so, however, let us illustrate the divisions. Consider, for example, the first three, theory, manipulation, and design. Men differ quite markedly in their interest in these three. If you should take a group of engineers through a factory or development laboratory and stop to show them some interesting process, you would find some men who want first to get the theory of the operation straight in their minds; others whose hands would just itch to get hold of the apparatus—who want to manipulate it, and seem to derive their ideas in part through muscular sensation; and a third group who will no sooner have seen the apparatus than questions involving changes in its design will arise in their minds—what if this element were made longer? or moved faster? and so on. These three types of interest are fairly well marked and you undoubtedly know in which way your mind naturally works.

Now let us illustrate the next three divisions. To do so imagine three young mechanical engineers leaving college to manage three small and isolated power plants. The first day they each walk around their respective plants and observe that the steam pressure is being inefficiently maintained. One man thinks immediately, "I have got to show those stokers how to fire a boiler. Now, what is the proper method of operation to be performed by human beings in firing a boiler?" Another thinks first, "I must get back to the office and look up those catalogues of automatic stokers. Now, what is the proper method of operation by physical apparatus in supplying coal to a boiler fire?" The third says to himself, "I must get out those tables which were published last spring and find out about how much it is justifiable to spend in a plant of

this size, per kilowatt hour, in boiler room operation; and then I can see what chance I have of employing an extra stoker or of installing automatic equipment." If these men are good engineers, they will ask themselves all three questions, but one question must come first. For one type of mind a certain question will precede the other two.

Now can you tell of these seven divisions which are first, second and third in your own interests?

Answering this question is more difficult than the first. It is sometimes necessary to suggest that the first three divisions be considered as a group and arranged in order, then that the next three be similarly treated, and finally that choice be made between the first choices of each group. In part this difficulty is due to the overlapping which occurs in the first six divisions and in part to the grouping which has been made use of in the accompanying explanation.

C. *Supervisory versus Technical Responsibilities.*—There is another question which may be helpful to you in analyzing your interests. As you progress in your engineering work you should, if you are capable, find yourself after a reasonable length of time in responsible charge of certain work.

Suppose you are in a large company. You might be in charge of a small department of ten or a dozen people, where your department was expected to make certain technical decisions. There might report to you two or three men, more recent graduates from college than yourself and more highly trained technically. Then there might be two or three men who had grown up in the industry, widely experienced practically but without a background of technical training. And associated with these two types a few assistants in routine matters, draftsmen, file clerks, stenographers, and the like. Your responsibilities are predominantly technical rather than supervisory.

On the other hand, you might find yourself in charge of a large department of three or four hundred people, engaged in three or four groups on related types of work each group headed by a man who reports to you. The members of your department are performing some of those more or less routine, more or less repetitive, tasks which enter into all industry and into engineering. Your responsibilities are predominantly supervisory rather than technical.

Now for purposes of discussion assume, what is in most cases true, that these two possible positions are equal in salary and in the recognition which is given to the man who holds the position and in opportunity for further advancement. Which position

would you naturally prefer, the supervisory or the technical responsibility?

This third question is not only the shortest and most quickly answered of the series but it is also apparently the most illuminating. Where the interview must be considerably curtailed this question is used and the first question omitted. It seems to separate immediately those whose urges are toward individual production or creation on the one hand and management on the other hand. In no instance has a man of the so-called "research type" failed to respond promptly in favor of technical responsibility.

In this connection it must be recognized that the method was developed for interviewing applicants of relatively small professional experience. To further his study the writer has asked some of his friends who are engineers of standing to answer these questions and then to try to figure out how they would have answered when their engineering careers were just starting. There is no doubt but that there is a shift of interests with maturity, which depends for its direction upon the original interests and upon past experiences and successes. For the purpose of any analysis, however, it is the applicant's present tendencies which should be considered.

D. *Basic Urges Toward Success.*—There is still another question the answer to which will help in analyzing your interests. Suppose we attempt to make a classification of the motives which dominate men and lead them to success. We might distinguish three different urges which are, however, present in all of us in greater or less proportions.

The first of these is an economic motive, a desire for more and more of the material things of this world. There are successful engineers who have contributed greatly to the progess of their art and to the welfare of society who are inspired largely by an economic urge. On the other hand, there are engineers who would never have risen to their present positions if the economic urge had been the only or even the dominant urge in their careers.

Some men rise because of personal ambition, the desire to be outstanding and to be individually recognized and approved. On the other hand, in many cases of success personal ambition is relatively small and the acquired reputations are the by-products of other and more dominant motives.

A third urge is that of production, the creative urge—what might be called the instinct of workmanship. This is a desire to create and to accomplish, which finds its pleasure and its satisfaction at the time and in the activity itself, rather than in the results which follow. There are engineers of high position and

good incomes who have risen under the urge of this instinct or motive.

No particular credit or discredit attaches to the dominance of any particular motive of the three, but men differ therein. Of course, it is very difficult to analyze one's motives and these three motives do overlap and are interrelated. However, supposing that their total is 100 per cent, how do you think in your case that the percentages are distributed among these three motives, (1) economic, (2) ambition, and (3) instinct of workmanship?

3. *Analysis of Interests of Engineers*

E. K. STRONG, "Interests of Engineers," *Personnel Journal*, 7:442-450 (1929); reprinted by permission of Williams & Wilkins Co.

It is of vital importance to ascertain the characteristics of men who are successfully and happily engaged in the various occupations. The loss sustained by society due to misfits in business and professional life must be very great. Considerable progress has been achieved through the development of general intelligence tests. But it is very apparent that many additional factors determine success besides mental alertness. One of these is *interest*. So far little attention has been given to this factor. The origin of interests is unknown,—whether due primarily to heredity or environment. If the latter is the case, as some contend, then individuals can be trained for any occupation, so far as interest determines success. If interests are basically the expression of inherent capacities, then it is of the utmost importance to ascertain them as early as possible. Thus far relatively little progress has been made in measuring inherent capacities. The procedure used here makes possible the measurement of interests and should lead to a greater understanding of this whole problem.

If further investigation establishes the fact that men engaged in a given occupation cannot be differentiated from men engaged in *every* other occupation; that men in any occupation have interests so nearly identical with men in *certain* closely related occupations that within this group of occupations they cannot be separated from one another in terms of interests, then there may emerge a classification and grouping of occupations of utmost significance in vocational counseling. In many respects it would be far better to tell a boy entering high school that his interests identify him with "Group C" occupations, including, for example, civil, electrical, mechanical, and mining engineering and chemistry, and possibly several others also, than to tell him his interests point toward any one of these alone. Such a system of vocational guidance can be

put into operation at much less cost today than one requiring the identification of the one best occupation, and it would lead in all probability to a broader and better educational preparation.

What will result from further research remains for the future to disclose. At this time the findings relative to the interests of engineers will be reported.

Interest Test Procedure.—The Vocational Interest Blank contains 420 items to each of which the individual reacts by indicating whether he likes (L), is indifferent to (I), or dislikes (D) it. The 420 items comprise 100 occupations, 54 amusements, 39 school subjects, 82 activities, 63 peculiarities of people, 42 miscellaneous items, and 40 estimates of present abilities and characteristics. The first ten items on the blank are given in Table I.

TABLE I

PROCEDURE IN DETERMINING WEIGHTS FOR SCORING FOR ENGINEERING INTERESTS

First Ten Items on Vocational Interest Blank	Per Cent of "Men in General" Who Like, Are Indifferent to and Dislike These Items			Per Cent of Engineers Who Like, Are Indifferent to, or Dislike These Items			Differences in Per Cents between Engineers and "Men in General"			Scoring Weights for Engineering Interests		
	L.	I.	D.	L.	I.	D.	L.	I.	D.	L.	I.	D.
Actor (not movie) ...	25	34	41	9	30	61	—16	—4	20	—6	—1	4
Advertiser ..	32	39	29	13	38	49	—19	—1	20	—6	0	4
Architect ...	42	37	21	57	32	11	15	—5	—10	3	—1	—4
Army officer.	26	29	45	32	32	36	6	3	—9	1	1	—2
Artist	33	37	30	29	38	33	—4	1	3	—1	0	1
Astronomer .	30	41	29	39	43	18	9	2	—11	2	0	—3
Athletic director	29	42	29	15	50	35	—14	8	6	—4	2	1
Auctioneer ..	6	23	71	1	16	83	—5	—7	12	—7	—2	4
Author of novel	37	37	26	23	42	35	—14	5	9	—3	1	2
Author of technical book	36	39	25	57	33	10	21	—6	—15	4	—1	—5

Data have been obtained from 3,920 men engaged in 30 occupations. The averages of their reactions to the items on the blank are taken as the bases from which to calculate the interest

peculiarities of each occupational group. Thus, in the first three columns of Table I are given the reactions of *men in general* to the item *actor;* 25 per cent say they would like to be an actor, 34 per cent are indifferent to being an actor, and 41 per cent would dislike to be an actor. Similarly, figures are given for nine additional occupational items.

TABLE II

DISTRIBUTION OF INTEREST BLANKS RECEIVED FROM THE FOUR ENGINEERING SOCIETIES

	Civil Engineers	Electrical Engineers	Mechanical Engineers	Mining Engineers	Totals
Outstanding men, selected by Dean T. J. Hoover...	25	26	23	20	94
Full members....	85	94	73	92	344
Associate members	43	31	30	33	137
Totals	153	151	126	145	575

Data have been secured from 575 engineers distributed among full and associate memberships from the four engineering societies (see Table II). Their expressed interests toward the first ten items on the blank are given in the second three columns of Table I. Evidently very few engineers wish to be actors, advertising men, athletic directors, auctioneers, or authors of novels. In contrast to men in general they are decidedly interested in being architects or authors of technical works.

The differences between the percentages given in the first three columns for *men in general* and the second three columns for *engineers* are given in the third three columns. These differences are reduced to "weights" as given in the fourth three columns of Table I. To calculate these weights an elaborate statistical formula is used in order to determine the very best weight in each case taking all the data into account. These weights constitute the scale by which a blank is scored for engineering interest. (By the same procedure scales have now been determined for twenty-six different occupations.)

In order to illustrate more fully the method by which a blank is scored, the reactions of a mining engineer to the first ten items are given in Table III. He dislikes being an actor, is indifferent to advertising, would like to be an architect, etc. Using the weights given in the last three columns of Table I, this mining engineer

obtains the scores shown under the heading *Engineer* in Table III. Using the appropriate weights for interest in journalism, public accounting, ministry, and the work of an artist he obtains the scores in the last four columns of this table. On the basis of these ten items this mining engineer shows distinct interest in engineering, slight preference toward accounting, and decidedly no interest in journalism and art. When all the 420 items on the blank are considered, he obtains total scores of 225 in engineering, minus 336

TABLE III

HOW A MINING ENGINEER SCORED THE FIRST TEN ITEMS ON THE INTEREST BLANK; ALSO THE WEIGHTS ASSIGNED WHEN SCORED FOR INTEREST IN EACH OF FIVE OCCUPATIONS

First Ten Items on Vocational Interest Blank	Actual Scores of a Mining Engineer			Engineer	Journalist	Public accountant	Minister	Artist
Actor (not movie)	L	I	(D)	4	0	1	—2	—2
Advertiser	L	(I)	D	0	—2	—2	1	—1
Architect	(L)	I	D	3	—4	0	2	4
Army officer	L	I	(D)	—2	2	0	1	1
Artist	L	(I)	D	0	—2	1	2	—13
Astronomer	L	(I)	D	0	0	0	—1	1
Athletic director	L	(I)	D	2	0	0	0	0
Auctioneer	L	I	(D)	4	2	0	—1	0
Author of novel	L	(I)	D	1	—5	0	1	—3
Author of technical work	(L)	I	D	4	—4	5	—2	—5
Totals	..	..	..	16	—13	5	1	—18

in journalism, 59 in public accounting, minus 263 in the ministry, and minus 509 as an artist.

There is still one more step before this mining engineer's standing in these five occupations can be properly evaluated. Because, for example, the scale for artists' interests contains many large weights, and the scale for public accounting contains very few large weights, it is easily possible to obtain a total of 200 in the interest of an artist, whereas such a score in C.P.A. interest is much more unusual. Because of this and other similar reasons, his total score was expressed in terms of three ratings tabulated as A, B, and C.

Seventy-five per cent of engineers obtain scores in engineering interest between 645 and 202. Twenty-four per cent obtain scores

between 201 and 1, and the remaining one per cent between 0 and —85. A rating of A is given to scores falling between 640 and 202; a rating of B to the range of 201 to 1; and a rating of C to a score of 0 or below. (The three letter ratings are similarly determined for the other occupations.)

A rating of A means the man has the interests of men successfully engaged in that occupation; a rating of C means he does not have those interests; a rating of B is intermediate and means he probably has these interests, but judging from this test alone one cannot be sure. The reason that a B rating must be interpreted as only *probably* indicative of interest in that occupation is that many men rate B in occupations other than their own. For example, the mining engineer referred to in Table III rates B in *public accounting.* Although his interests coincide with those of some public accountants, yet his interests are not sufficiently in that direction to warrant one saying more than that he probably has the interests of a public accountant.

In order to give an idea of the extent to which a man's interests may overlap, the ratings of this mining engineer are given here for twelve different occupations, as follows:

Engineer	A	Lawyer	B —
Chemist	A	Life insurance salesman ...	C
Personnel manager........	B +	Advertising man..........	C
Purchasing agent.........	B +	Artist	C
Public accountant.........	B	Minister	C
School teacher............	B —	Journalist	C

Differentiation of Engineers from Non-Engineers.—The Interest Blanks of 933 non-engineers, representing seventeen occupations, were scored for engineering interest. The results are given in Table IV. Whereas 75 per cent of engineers rate A, 24 per cent rate B, and 1 per cent rate C, only 15 per cent of the 963 non-engineers rate A in engineering interest, 40 per cent rate B, and 45 per cent rate C.

There is, however, a very great difference in the extent to which men in various occupations score like engineers. The interests of chemists (including many chemical engineers) are very similar to those of engineers,—half rate A and half B, whereas three-fourths of engineers rate A and one-fourth B. Farmers (all graduates of an agricultural college who have worked at least five years on a farm) and architects also rate high in engineering interest. On the other hand, the interests of real estate salesmen, authors, ministers, advertising men, and life insurance salesmen are very dissimilar.

The large amount of overlapping between these occupations and engineering indicates that, as far as interest is concerned, many men in other occupations might just as well have been engineers. The reverse is also the case, as is later shown. It is a difficult matter to decide whether the men in these occupations who rate A in engineering interest should have been engineers or not. If so they are actually misplaced today. In some cases the evidence

TABLE IV

EXTENT TO WHICH MEN IN 17 OCCUPATIONS ARE RATED FOR ENGINEERING INTEREST

Occupations	Per Cent Rated		
	A	B	C
Chemists	47	50	3
Farmers	37	49	14
Architects	34	54	12
Psychologists	24	46	30
Surgeons	22	53	25
Personnel managers	19	36	45
Purchasing agents	14	56	30
Public accountants	13	51	36
School teachers and administrators	12	46	42
Lawyers	8	39	53
Journalists	7	31	62
Artists (painters)	6	49	45
Real estate salesmen	4	28	68
Authors	3	33	64
Ministers	2	25	73
Advertising men	0	35	65
Life insurance salesmen	0	23	77
Average	15	40	45

seems to substantiate this view. In other cases there is nothing to indicate but that they are properly placed. The amount of evidence that has been gathered is, however, insufficient to answer the question. In fact it is doubtful if it would be possible at the present time to establish objective standards by which such questions could be answered.

Extent to Which Engineers Have Interests Similar to Men in Other Occupations.—The Interest Blanks of 62 full members of the American Society of Mechanical Engineers were scored for interest in nineteen occupations in addition to that of engineering. As a check, blanks of full members in the other three engineering

societies were scored for several occupations (see Table V). Evidently engineers have very much the interests of chemists (56 per cent of engineers rate A and 34 per cent B). To a much less degree engineers have the interests of medical men, personnel man-

TABLE V

EXTENT TO WHICH ENGINEERS HAVE INTERESTS SIMILAR TO MEN IN OTHER OCCUPATIONS

Occupational Interests in Terms of Which These Engineers are Rated	Per Cent of Mn. E. Who Are Rated			Per Cent of C. E. Who Are Rated			Per Cent of M. E. Who Are Rated			Per Cent of E. E. Who Are Rated		
	A	B	C	A	B	C	A	B	C	A	B	C
Chemists	56	34	10									
Medical men	17	56	27									
Personnel managers	16	54	30									
Purchasing agents	15	75	10									
Farmers	8	71	21									
Architects	6	57	37	13	53	54						
School teachers	6	38	56									
Lawyers	2	66	32	8	79	13	9	71	20	3	72	25
Journalists	2	48	50									
Psychologists	2	30	68									
Real estate salesmen	2	24	74									
Public accountants	0	51	49	5	57	38	2	61	37	6	44	50
Vacuum cleaner salesmen	0	21	79									
Ministers	0	17	83									
Life insurance salesmen	0	14	86									
Y. M. C. A. secretaries	0	13	87									
Advertising men	0	8	92									
Artists	0	2	98	0	10	90						
District sales managers of vacuum cleaners	0	0	100									

agers, and purchasing agents. Almost no engineers rate A in the remaining fifteen occupations. Engineers do not have the interests of men engaged in other work to anything like the degree that these men have interests in common with engineers. There are too many complicating factors entering into this study, however, to warrant drawing the natural conclusion that engineers have less broad interests than men in other lines of work.

As the correlation between the order in which the occupations are listed in Tables IV and V is .81, it is justifiable to conclude that the interests of engineers are related to the interests of men in other occupations as appear in these tables. This does not mean that the occupations are so related, but only that the men engaged in these occupations have interests approximating those of engineers to the degree represented in the tables. It would appear that boys showing interest in the occupations listed on the upper half of these two tables are likely to become interested in engineering and, if so, might be encouraged; whereas boys interested in the occupations listed on the lower half of these tables are unlikely to become engineers, and should ordinarily not be encouraged to consider engineering.

Extent to Which the Four Engineering Groups Can Be Differentiated on the Basis of Their Interests.—A considerable number of engineers were asked whether or not the four major groups of engineers were essentially alike in their interests. The answers differed considerably. Some believed all engineers were very much alike; others felt there were differences, particularly in the case of civil engineers. Almost all stated that mechanical and electrical engineers were most alike.

In Table VI are given the per cents of each of the four groups of engineers who rate A, B and C, in engineering interest. As the test is based on approximately equal representations from all four engineering societies, high ratings mean approximation to the average of the four groups and low ratings the reverse. The results indicate that mechanical engineers are most similar to the average engineer and mining engineers are least like the average.

TABLE VI

ENGINEERING INTEREST OF THE FOUR ENGINEERING GROUPS

	Per Cent of C. E. Who Are Rated			Per Cent of E. E. Who Are Rated			Per Cent of M. E. Who Are Rated			Per Cent of Mn. E. Who Are Rated			Per Cent of all Engineers Who Are Rated		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
Full members.	78	19	3	79	18	3	86	14	0	74	24	2	79	19	2
Associate members	63	37	0	81	19	0	82	18	0	52	48	0	69	31	0
Total	71	27	2	80	18	2	84	16	0	67	32	1	76	23	1

TABLE VII

EXTENT TO WHICH CIVIL, ELECTRICAL, MECHANICAL, AND MINING ENGINEERS HAVE INTEREST IN THESE FOUR TYPES OF ENGINEERING

Engineering Interests in Terms of Which These Engineers are Rated	Per Cent of C. E. Who Are Rated			Per Cent of E. E. Who Are Rated			Per Cent of M. E. Who Are Rated			Per Cent of Mn. E. Who Are Rated		
	A	B	C	A	B	C	A	B	C	A	B	C
Civil engineering.	84	13	3	63	29	8	54	43	3	44	51	5
Electrical engineering	51	35	14	71	24	5	64	35	1	34	54	12
Mechanical engineering	51	35	14	55	39	6	79	21	0	41	44	15
Mining engineering	65	32	3	68	27	5	70	27	3	83	17	0

TABLE VIII

CORRELATIONS BETWEEN SCORES IN INTEREST FOR ENGINEERING IN GENERAL, CIVIL, ELECTRICAL, MECHANICAL, AND MINING ENGINEERING AND PUBLIC ACCOUNTING (BASED ON RECORDS OF 63 CIVIL ENGINEERS)

	Engineering in General	Civil Engineering	Electrical Engineering	Mechan. Engineering	Mining Engineering
Civil engineering...	.931				
Electrical engineering	.956	.864			
Mechanical engineering	.946	.837	.923		
Mining engineering..	.929	.855	.964	.854	
Public accounting...	.246	.345	.250	.156	.221

Differences between the four engineering groups are not so easily discovered by comparing how each of the four approximate the average of the four, as by directly contrasting each group with the three others. In order to accomplish the latter, interest scales were developed for each of the four groups. Sixty-two blanks of full members of each society were then scored for interest in civil, electrical, mechanical, and mining engineering. The results are shown in Table VII.

Here again mining engineers differ more from the three other groups than do any of the three others. Civil engineers come next in the extent to which they differ, while no significant difference

between electrical and mechanical engineers is to be noted in this respect. These conclusions are based both on the percentages that rate A and, possibly, even more strikingly on the percentages that rate C. Thus 12 to 15 per cent of mining and civil engineers do not rate at all like electrical and mechanical engineers.

The differences in interests among these four engineering groups are, however, very slight. The inter-correlations between the general engineering test and those for civil, electrical, mechanical, and mining are all so high (Table VIII) that they must be considered as practically identical. This is emphasized all the more when correlation between these five and interest in public accounting are taken into account.

On the whole the *outstanding men* selected by Dean Hoover secure higher scores, and the associate members lower scores, than full members, when the four groups of engineers are scored on their respective scales (see Table IX). There are two exceptions: full members score higher than *outstanding men* among civil engineers, and associate members score a trifle higher than full members among electrical engineers. Here again, as in Table VI, associate members of electrical and mechanical engineering societies score approximately as do full members, whereas associate members of civil and mining engineering societies score lower than their full members.

TABLE IX

EXTENT TO WHICH "OUTSTANDING MEN," FULL MEMBERS, AND ASSOCIATE MEMBERS RATE IN THEIR OWN TYPE OF ENGINEERING INTEREST

Type of Engineering Interest	Per Cent of Outstanding Men Who Are Rated			Per Cent of Full Members Who Are Rated			Per Cent of Associate Members Who Are Rated		
	A	B	C	A	B	C	A	B	C
Civil engineers	75	25	0	82	15	3	63	37	0
Electrical engineers	84	16	0	72	25	3	74	26	0
Mechanical engineers	84	16	0	75	25	0	70	30	0
Mining engineers	81	19	0	76	24	0	59	41	0
Average	81	19	0	76	22	2	67	33	0

Individual Execeptions.—Two per cent of full members of the four engineering societies rate C in engineering interest (see Table VI). Is there any explanation of this fact? Is the interest test

faulty to this extent, or do the interests of these men prove them to be "at heart" not engineers? A letter of inquiry was sent to the five men comprising this group who rate C and also to three additional men who rate a low B. Only two replied. The available facts taken mainly from the blanks are:

E. E., No. 49, 50 years old, designs electrical equipment, primarily surgical instruments. Received M.D. degree at college. Rated C in engineering in general and in all four engineering groups.

E. E., No. 36, 43 years old, is apparently a typical electrical engineer for a Light and Power Company. Finished college engineering course. Has day-dreamed of "real estate, stocks and bonds." Remarks, "I have always had a general tendency for entering the commercial field, in the above mentioned lines." Rated C in all five tests.

C. E., No. 46, 38 years old, has general supervision of all kinds of construction work. M.S. degree. Remarks, "I plan to go into general contracting for myself at some time in the future, but I am well pleased with my present connections." Rated C in all five tests.

C. E., No. 56, 41 years old, is chief engineer in charge of design of buildings. Has been an assistant professor in college. Has day-dreamed of consulting work, also sales agent. Remarks, "With present salary and participation in company's earnings, I have not felt inclined to venture into new fields." Rated C in all five tests.

Mn. E., No. 49, 39 years old, is safety director for a group of mining companies, M.S. degree in Mining Engineering. Rates C in all tests except that of mining engineering on which he receives B —.

E. E., No. 62, 37 years old, is selling electrical equipment requiring "very little engineering at all." Is going to leave as soon as able. E.E. degree. Prefers public utility work and teaching, of which he has had previous experience. Rates B — in general engineering and C.E.; rates C in other three tests.

Mn. E., No. 58, 42 years old, locates areas favorably located and drills or causes to be drilled test wells for petroleum. University graduate. Day-dreams of fiction writing, sketching and painting. Remarks, "I like the field-work of my profession, but detest the business, or 'trading' part of it. My inclinations are largely toward literature, art, and travel, rather than 'business.'" Rates B in mining engineering, B — in general engineering and C in the other three tests.

Mn. E., No. 57, 34 years old, carries on business of discovering geologic structures favorable to oil and gas, secures leases, prepares maps, sells interests, drills wells, etc. College man, day-dreams of "advanced study in geology and travel; possibly connection with Geological Survey or college." Rates B in mining engineering, B — in general engineering and civil engineering and C in electrical and mechanical engineering.

The reader may draw his own conclusion as to whether or not these men are truly engineers. If so, the test is faulty to that

extent in rating them as *not engineers.* It is unfortunate that no information is available as to salary and estimates of others regarding their fitness for their work. Their business connections in most cases suggest they hold responsible positions.

4. *A Test of Scientific Aptitude*

D. L. Zyve, "A Test of Scientific Aptitude," *Journal of Educational Psychology,* 18:528-535, 545-546 (1927); reprinted by permission of Warwick & York, Inc.

If scientific aptitude S is a complex conglomerate of mental and character traits, as is probably the case, it ought to be analyzable into its components such as:

$$S = A + B + C + D + E + F + G \ldots \text{etc.},$$

where A is, let us say, ability to reason (original, not routine reasoning), B ability to form generalizations through the inductive method, C accuracy of observation, D discrimination of values in selecting and arranging experimental data, E power of suspended judgment, F patience or sustained effort, G imagination (including creative imagination), H devotion to truth, I muscular coördination, J orderliness, K sensory acuity, and so on.

Even a superficial examination of these variables suggests that for our purpose they are not of equal importance. Some of these factors may be fundamental and their lack may not be compensated by training, as, for example, a consistent deficiency in reasoning ability; others may be of lesser importance and subject to improvement, or to development through training, such as, for example, lack of caution or a tendency toward hasty generalization; still others may be purely accidental and due primarily to environment, such as habits of work or ways of living.

Which of the elements should be incorporated into a scientific aptitude test?

The last group is obviously beyond the scope of our study, and will not be taken into consideration. The elements of the second group, while not essential, according to some men of science, are significant for the purposes of differentiation, and, therefore, should be incorporated into our definition of scientific aptitude. As for the elements of the first group, they are, as we have said, fundamental, and form the "core" of scientific aptitude. Even reduced to its fundamental elements the resulting compound, which we call scientific aptitude, may be very complex. Moreover, neither the total number of its fundamental constitutents nor their nature may be known. The last difficulty, however, is not crucial, *if we*

succeed in proving that a test based upon a limited number of elements may show an acceptably high correlation with aptitude as detected by some other method, such as actual performance in the field of science.

We shall then include in the test of scientific aptitude the following elements:

1. *Clarity of definition,* i.e., the ability of the student to differentiate better definitions from poorer ones, and appreciate their relative values.

2. *Experimental bent,* i.e., the tendency of the student toward experimentation.

3. *Suspended vs. snap judgment,* i.e., the tendency of the student to draw final conclusions from insufficient data.

4. *Discrimination of values* in selecting and arranging experimental data.

5. *Detection of fallacies* and contradictions.

6. *Reasoning,* i.e., the ability to reason not only according to well-established rules such as may be found in certain typical mathematical problems but also so far as possible, original reasoning.

7. *Accuracy of systematic observations,* i.e., the ability to observe patiently and accurately by adopting some method of systematization.

8. *Induction, deduction, and generalization,* i.e., the ability of the student to use given experimental data and form correct inductions, deductions and generalizations.

9. *Accuracy of understanding and of interpretation,* i.e., the ability to grasp the true meaning of a given body of information and to interpret it correctly.

10. *Caution,* i.e., the tendency of the student to pause to investigate before adopting a method of behavior.

It is self-evident that most of these traits cannot be isolated without overlapping. The test elements, however, have been designed in such a way as to emphasize the outstanding traits, and to reduce overlapping to a minimum. The following samples of the Test of Scientific Aptitude will give an approximate idea of the nature of the test.

Definition (Four Exercises).—Rank the following definitions of a bow according to merit, i.e., write 1 next to the best definition, write 2 next to the second best, etc. The poorest definition will receive the rank of 4.

- **A bow is a weapon used by primitive people, either in war or for hunting small and even large game by means of arrows.**

—— A bow is a piece of wood which, after having been bent into an arc, is used for shooting arrows.

—— A bow is a weapon well known in every country from time immemorial.

—— A bow is a weapon made of a strip of wood or other material, the two ends of which are connected by a cord, by means of which an arrow may be projected.

The final form of the test includes the definitions of four terms. These definitions were ranked by seven judges selected from among the faculty members in science and engineering departments at Stanford University. Only those definitions were adopted upon which unanimity of the judges was secured.

Suspended vs. Snap Judgment (Five Exercises).—Put a check (√) next to the correct answer to the question given below:

1. What is the population of this country going to be in the year 3000?

About 150 million; about 300 million; about 500 million; over 500 million. If unable to tell put a check here ——.

Obviously, no correct answer can be given to this question and those who have the tendency of suspending their judgment when data are incomplete will admit their inability to answer the question.

2. A certain government, selling land, offered it on the following terms:

1. If a buyer is an immigrant he may pay:
   $1,000 every year for 20 years
2. If the buyer is a native born, he may pay:
   $200 the first year
   $400 the second year
   $600 the third year and so on; the annual payment increased by $200 each year for 20 years
3. If he is a war veteran he may pay:
   $1 the first year
   $2 the second year
   $4 the third year, etc., the annual payment being doubled each year for 16 years

Which of the buyers get the best terms?
Answer here ——
If unable to answer, check here ——

In this case, the correct answer may be found by simple computation; yet the number of those who were tempted to make a guess was quite considerable.

Discrimination of Values in Selecting and Arranging Experimental Data (Five Exercises).—A physicist wanted to measure the length of a fine wire with precision; for this reason he measured it several times. Below are given the results of his measuring.

First measure	14.63 cm.
Second measure	13.13 cm.
Third measure	13.12 cm.
Fourth measure	13.14 cm.
Fifth measure	13.13 cm.

What is the probable length of the wire? Answer here ——.

Obviously, the first measuring in this exercise must be disregarded by the individual tested.

Discrimination of Values.—You wish to find the increase in population of your home town between January 1, and December 31, 1924. The only data available are those given below. Check those facts only which are necessary to solve the problem.

—— The number of births which occurred in your town in 1924.
—— The number of people who intend to leave town in 1924.
—— The number of people killed by accidents in your town in 1924.
—— The number of people arrived during 1924 and now living in your town.
—— The number of children born in hospitals in 1924.
—— The population of your town on January 1, 1924.
—— The number of people in your town who died of sickness in 1924.
—— The number of people in your town murdered in 1924.
—— The number of people moved out of your town during 1924.
—— The number of children born in homes in 1924.
—— The number of guests in hotels in 1924.
—— The number of deaths which occurred in your town in 1924.
—— The number of people in your town who died of old age in 1924.

Experimental Bent (Five Exercises).—Suppose that you have *plenty of leisure* and *the necessary means* for meeting the situations described below. *Check frankly* the statement which comes nearest to the way in which your *first impulse* would lead you to handle the matter. (If you wish to be helped by this test you must be absolutely frank.)

You wish to get the lowest possible temperature from a mixture of ice and salt, but found contradictory statements in two books as to the accurate proportion of salt and ice.

(*a*) Take a proportion of ice and salt that is an average of those suggested by the books.

(*b*) Mix ice and salt in suggested proportions and check the information given in the books.
(*c*) Call up an ice-cream factory and secure the information needed.
(*d*) Remarks.

The test of this trait has been devised so as to detect not the actual experimental ability due to training, but the first impulse, which is actually symptomatic of a "bent." It does not matter whether the answers to various questions of this test element are exactly applicable to real situations, that is, whether the individual would *actually* proceed in the way he indicated had he been placed in a corresponding life situation. What matters is that following his first impulse, he would be inclined to proceed in the way indicated by him rather than in any other way. Once an experimental bent is detected, the degree of experimental ability is but a matter of training, other things being equal.

Reasoning.— . . . There is a train leaving City *A* every hour (at the hour) and going to City *B*. At the same time another train leaves City *B* going to City *A*. The journey lasts exactly 10 hours. You took a train from *A*. How many trains did you meet on your way to *B*, counting the one that reaches *A* at the moment of your departure and the one that leaves *B* at your arrival? Answer here ——.

(The correct answer is 21.)

Fallacies and Inconsistencies.—The *Evening Star* correspondent writes from the City *X*: "A plan was offered to the City *X*, located on the shore of Lake Ontario, by which it was proposed to generate at low cost electric light and power for the vicinity. The method consisted in digging a deep pit in the lowest part of the shore at the bottom of which the plant was to be located. The cost of equipment for the plant would be relatively low as it would consist only of generators run by turbines to which the lake water would lead through a large pipe."

At the meeting of the council various reasons were given by the members either for or against the project. Check (X) any of the statements you would endorse, and (—) those to which you would object.

(*a*) I am in favor of this project for the plant will be as efficient as any using a natural waterfall.
(*b*) I oppose this project for the plan is impracticable.
(*c*) I am in favor of this project for very cheap power could be generated by the proposed method.
(*d*) I am opposed to this project for such a plant would be unsanitary.

Of course (*b*) is the correct answer; as for (*d*), it should be checked —, for, obviously enough, a flooded pit would be more than unsanitary.

Read each of the following paragraphs. If a paragraph is consistent throughout, put an (X) in front of it; if it is not, put a (—). · (You need no special information on the topics discussed below.)

1. White light is a mixture of various rays, the "wave lengths" of which decrease as we proceed from red to violet. Rays of still shorter wave lengths are not visible to the eye. Among these, some rays, such as ultra-violet rays and X-rays find many applications in medicine. The X-rays, the wave length of which is approximately double that of the violet rays, are used in surgery.
2. A body lighter than its volume of water will float in water. Sodium is lighter than its volume of water. Sodium is a metal. Metals usually sink in water. A chunk of metallic sodium thrown into water will float.

Induction, Deduction and Generalization (Two Exercises).—A scientist on a distant planet, in a universe different from ours, was trying to discover the law governing the behavior of gases. He took a certain amount of gas which occupied exactly 100 cubic feet and with a pressure gauge found the pressure of the gas was 1 lb. per sq. in. He then compressed that same amount of gas to a volume of 50 cubic feet. At that moment the pressure gauge read 4 pounds. He proceeded then compressing the gas more and more. Below are recorded the results of his experiment. (The temperature of the gas remained the same throughout the experiment.)

Volume of Gas	*Pressure*
100 cu. ft.	1 lb. per sq. in.
50 cu. ft.	4 lb. per sq. in.
25 cu. ft.	16 lb. per sq. in.
12.5 cu. ft.	64 lb. per sq. in.

1. Under what pressure will the gas be reduced to a volume of 6.25 cubic feet?

2. Supposing that the gas behaves as indicated above, what formula will express the general law governing the behavior of gases on that planet?

Call V the volume of the gas and P the corresponding pressure. Answer here ——.

In connection with this exercise one need not be alarmed by the apparent violation of the Principle of Uniformity. Under the circumstances such violence was harmless, and, moreover, it enabled

us to devise experimental situations the laws of which could not be memorized in a high school physics text-book. For what we intend to test through this exercise is not memory, nor even intelligent information, but the ability for forming correct quantitative generalizations.

Accuracy of Observation.—The test consists in completing a geometric design so as to make it identical with another one. To those who have no acute sense of observation and are unable to analyze systematically a complex situation into its elements, the exercise appears decidedly complicated.

Caution and Thoroughness (Eight Exercises).—The exercises are based upon various optical illusions, which have been arranged with the purpose of meeting two ends: First, to determine whether the student is cautious enough to read the instructions carefully (as he is invited to do); second, whether he is thorough enough to carry out these instructions without being influenced by the apparent ease of the task or by faulty inductions.

Accuracy of Interpretation.—The correctness of interpretation is tested by a multiple choice set of questions based upon more or less technical material.

In our investigation we felt justified in assuming, temporarily at least, that the process of creative imagination in science is generically similar to, if not identical with, the processes involved in analogical thinking, reasoning, forming inductions, deductions, and generalizations.

If this assumption is correct, and it is at least more rational than those held by the mystically inclined, then with adequately selected test material, we ought to be able to detect the so-called creative imagination even on higher levels of scientific aptitude. In other words, there ought to be an acceptably high correlation between the scores on the scientific aptitude test and actual aptitude as determined by means of a reliable criterion in order to test this assumption as well as to determine the validity of our test. . . .

Résumé

1. Since no single test can embrace all the complex mental and character traits of an individual, the problem of intelligent differentiation and guidance of incoming college students must be approached from several sides by means of objective reliable and valid tests of the most important of these traits. One of these traits is aptitude for science or engineering.

2. After having analyzed scientific aptitude into its probable

components, corresponding test elements were devised and adequate weights attached to them.

3. The Test of Scientific Aptitude was given to a group of 50 research students in the departments of physics, chemistry and electrical engineering at Stanford University, and their scores correlated with those assigned to them independently by competent judges in each of the departments. The correlations (product-moment) found were .95 ± .02, .77 ± .06, and .89 ± .03 respectively.

4. The validity of the Test of Scientific Aptitude was found to be .82 ± .07 and its reliability .93 ± .02.

5. The correlations with the Terman Group Test of Mental Ability and with Thorndike's Intelligence Examination range from .14 ± .10 to .58 ± .02.

6. The test was also given to senior and graduate students in non-scientific departments (English, history, languages, etc.) and the correlation of TSA scores with the students' scholarship during the senior year is .019 ± .091, while the correlation of Thorndike's scores with scholarship for the same group is .41. On the other hand the correlation between university scholarship during the senior year and the TSA scores of a group of Stanford research students in science or engineering is .51 ± .07, while a similar correlation between Thorndike's Examination scores and the average university scholarship of a group of engineering students is .27 ± .06.

The above data corroborate the conclusion that the Test of Scientific Aptitude is different in nature from the Thorndike Intelligence Examination and similar intelligence tests.

7. The diagnostic and prognostic values of the TSA have been shown both through cases of agreement and cases of disagreement with the judges. Moreover, the comparative study of the responses of graduate research students and faculty on the one hand, and of unselected freshmen on the other, definitely shows that the TSA is a test of Aptitude rather than of training, and is capable of differentiating scientific aptitude among highly selected and trained groups.

QUESTIONS

1. In what respect is the "interest" of a mature person in his vocation like, or different from, a student's "interest" in a particular course?
2. How may both special ability and special interest be due to some third unknown factor; that is, what might such a factor be?
3. Even though the choice of one occupation or activity as liked or disliked in the Moore or Strong interest test will not be a safe indication of interests, why may the tests have validity?

CHAPTER VIII

VOCATIONAL GUIDANCE

The field of vocational guidance is best understood in terms of its resemblance to vocational selection. In vocational selection (which has been the major theme of the chapters covered up to this point) our problem is essentially that of finding a man to fill a definite job. Since there are normally many more applicants for a position than can be accepted, a process of elimination occurs until ideally the most satisfactory candidate remains. In vocational guidance, the emphasis of the situation is practically reversed. Here we have a case where a subject with given psychological attributes must be oriented into a suitable group of occupations. It is hard to exaggerate the complexity and difficulty of such a task.

Responsibility for vocational guidance is not entirely distinct from responsibility for vocational selection. It falls on employers as well as on schools and other agencies. There must be guidance in the business or industrial organization. This is more apparent when promotions are considered. Better management is even assuming some responsibility for guidance in the employment interview, although the applicant cannot be accepted, and in the exit interview when the worker leaves the organization.

Misconceptions flourish in the field of guidance as luxuriantly as in other branches of applied psychology. A common error appears in the hope, "If only I could find the one career for which I am best fitted!" It is unlikely that most men are designed by a provident nature to do just one thing better than any other person. The following line of thought will suggest the imperfections in this belief: Man's basic mental traits were formed millenniums ago to cope with the stimuli offered by a jungle environment. Is it reasonable to suppose that these hereditary characteristics fit a youth for just one of the thousands of occupations listed in the United States Census; especially when it is realized that these occupations come and go

with changes in the industrial and economic order? The strong boy who was told to become a blacksmith in 1900 has probably taken a different job by this time. The truer view seems to be that most people could enter a number of occupations with about equal chances of success. A good student who gives promise of being an efficient teacher would very likely be equally competent in law, medicine, or the ministry.

Consider the following case: A senior in a college of liberal arts is on the verge of graduation but is still undecided on a career. He comes to a vocational counselor for advice. His record indicates that he is twenty-two years old, 6 feet tall, and 185 pounds in weight. His Alpha intelligence score is 197 (with a college average of 150; the highest possible score is 212); his academic average is A —; and he has just been elected to Phi Beta Kappa. He has no financial resources whatever but, as he is in love, he wants to marry as soon as possible. What recommendations do you think ought to be made?

Even with detailed information about such a person's temperamental traits, the best one could do would be to offer him material descriptive of the requirements and opportunities of certain vocations and let him make his own decision. It would be absurd to suggest bookkeeping or cow-punching to such an individual; the high-grade professions are undoubtedly the most plausible fields. Assuming a choice has been made, the rest is a matter of expediency, and of educational rather than vocational guidance. The girl would probably have to wait while he borrowed money (which he could readily do, being a good educational risk) to finance the necessary graduate studies.

Actual cases are more irregular and correspondingly hard to treat. The most the psychologist dares do at present is discourage obviously "wild" selections. A boy with an I.Q. of 82 who wants to be a physician (perhaps because his parents encourage the idea) had better be told that successful doctors must be a little brighter than that. Similarly, a tone-deaf girl should be dissuaded from studying music.

The vocational advisor needs to know economics as well as psychology. Studies indicate that most school children desire to enter occupations higher in the social scale than their father's. The law of supply and demand alone would forbid the whole-

sale fulfillment of such wishes even if their talents were adequate to attain them.

As already pointed out by Scott, pages 94-96, we need to substitute the biological concept of the worker-in-his-work for the inadequate concept of the square-peg-in-the-square-hole. Some principles and methods, however, have been discovered which can be used as valuable aids for guiding the individual into a situation where he can function satisfactorily in his vocational life. In this chapter are found selected reports of these.

A. Nature of the Problem

1. *First Principles in Vocational Guidance*

F. A. Parsons, *Choosing a Vocation*, 5 (Houghton Mifflin, 1909)

In the wise choice of a vocation there are three broad factors: (1) a clear understanding of yourself, your aptitudes, abilities, interests, ambitions, resources, limitations, and their causes; (2) a knowledge of the requirements and conditions of success, advantages and disadvantages, compensation, opportunities, and prospects in different lines of work; (3) true reasoning on the relations of these two groups of facts.

Every young person needs help on all three of these points. He needs all the information and assistance he can get. He needs counsel. He needs a vocational counselor. He needs careful and systematic help by experienced minds in making this greatest decision of his life.

The more light he can bring to bear on the problem from his own observation, reading, and experience, the better it will be for the clearness and strength of the conclusions arrived at, and the permanent value of the results attained. The first step, therefore, is self-study.

To win the best success of which one is capable, his best abilities and enthusiasms must be united with his daily work. He needs, therefore, to investigate himself in order to determine his capacities, interests, resources, and limitations, and their causes, so that he may compare his aptitudes, abilities, and ambitions, etc., with the conditions of success in different industries.

2. *The Points of a Good Job*

R. C. Cabot, *What Men Live By*, 27-28 (Houghton Mifflin, 1914)

What (besides better hours, better wages, healthier conditions) are the points of a good job. Imagine a sensible man looking for

satisfactory work, a vocational adviser guiding novices toward the best available occupation, and a statesman trying to mould the industrial world somewhat nearer to the heart's desire,—what should they try for? Physical and financial standards determine what we get *out* of our work. But what shall we get *in* it? Much or little, I answer, according to its fitness or unfitness for our personality,—a factor much neglected nowadays.

Among the points of a good job I shall name seven: (1) Difficulty and crudeness enough to call out our latent powers of mastery. (2) Variety so balanced by monotony as to suit the individual's needs. (3) A boss. (4) A chance to achieve, to build something and to recognize what we have done. (5) A title and a place which is ours. (6) Connection with some institution, some firm, or some cause, which we can loyally serve. (7) Honorable and pleasant relation with our comrades in work. Fulfill these conditions and work is one of the best things in life.

B. Predicting Careers

3. *Intelligence Levels of Occupations*

DOUGLAS FRYER, "Occupational-Intelligence Standards," *School and Society*, 16.273-277 (1922)

With intelligence as a standard there are several definitely determined occupational levels *blocking* an individual into the field of his occupational achievement. The man who is vocationally unsuccessful and dissatisfied may find: (1) that he is attempting to succeed in an occupation demanding greater intellectual capacity than is his; or (2) that he is in an occupation which fails to make sufficient demands upon his intellectual capacity to keep him interested and at work. However, it should be noted in this connection that rather simple concrete mechanical processes are frequently enjoyed by men of superior intelligence during the period of apprenticeship, because then, during the time of learning, there is a greater demand upon the intelligence.

Occupational levels with intelligence as a basis for the grouping can be roughly classified as follows:

I. Professional Occupational Level (superior intelligence required)	A. Professional work with very high educational and professional standards
	B. Professional work with slightly lower educational and professional standards

II. Technical Occupational Level (high average intelligence required)	Technical work; business promotion; clerical work; high skilled mechanical work demanding leadership qualifications
III. Skilled Occupational Level (average intelligence required)	Skilled mechanical work of concrete nature
IV. Semi-Skilled and Low-Skilled Occupational Level (low average intelligence required)	Mechanical work demanding some occupational skill
V. Unskilled Occupational Level (inferior intelligence required)	Manual work demanding no skill

The occupational territory of an individual is bounded by his intellectual capacity; he is blocked off into an occupational field with intelligence as the standard for classification. A classification of the occupations with intelligence as the basis for the groupings is essential information for a vocational office. Occupational levels have been clearly indicated by many studies of intelligence.

The intelligence rating secured through the intelligence examination compared with occupational-intelligence standards would appear to be a significant guide in the judgment of workmanship ability. (It must be remembered, however, that the intelligence rating as a guide to workmanship ability is limited by the fact that the examination is a measure of *instantaneous* capacity; the emotional qualities necessary to intellectual achievement, i.e., success in intellectual work, contribute possibly 40 per cent to such intellectual achievement.) Equally such occupational-intelligence standards may be of great assistance in the process of vocational counsel and in the selection of personnel.

It was in an attempt to furnish occupational-intelligence standards for the vocational counseling and occupational selection processes that this work was begun over two years ago in the vocational department of the Central Branch, Y.M.C.A., Brooklyn. A short list of occupations with their respective intelligence requirements was roughly assembled as a result of the study of a few hundred cases. When the results of the occupational studies made by the Division of Psychology S. G. O. became available these occupational-intelligence standards were corrected and amplified. Four studies were made by the Division of Psychology in army cantonments (Dix, Lee, Wadsworth and Devens) and a most exhaustive one was an assembling in the S. G. O. of data from sixteen army

OCCUPATIONAL-INTELLIGENCE STANDARDS

Intelligence Standard Index: 96 Occupational Designations

Intelligence Group	Score Average	Score Range	Occupation
	161	110-183	Engineer (civil and mechanical)
A	152	124-185	Clergyman
	137	103-155	Accountant
	127	107-164	Physician
	122	97-148	Teacher (public school)
	119	94-139	Chemist
B	114	84-139	Draftsman
	111	99-163	Y. M. C. A. Secretary
	110	80-128	Dentist
	109	81-137	Executive (minor)
	103	73-124	Stenographer and typist
	101	77-127	Bookkeeper
	99	78-126	Nurse
	96	74-121	Clerk (office)
	91	69-115	Clerk (railroad)
	86	59-107	Photographer
	85	57-110	Telegrapher and radio operator
	83	64-106	Conductor (railroad)
C +	82	57-108	Musician (band)
	81	59-106	Artist (sign letterer)
	81	60-106	Clerk (postal)
	81	57-109	Electrician
	80	62-114	Foreman (construction)
	80	56-105	Clerk (stock)
	78	54-102	Clerk (receiving and shipping)
	78	61-106	Druggist
	77	59-107	Foreman (factory)
	75	56-105	Graphotype operator
	74	53-91	Engineman (locomotive)
	72	54-99	Farrier
	70	46-95	Telephone operator
	70	44-94	Stock checker
	69	49-93	Carpenter (ship)
	69	48-94	Handyman (general mechanic)
	69	46-90	Policeman and detective
C	68	51-97	Auto assembler
	68	47-89	Engineman (marine)
	68	42-86	Riveter (hand)
	67	50-92	Toolmaker
	66	45-92	Auto engine mechanic
	66	45-91	Laundryman
	66	49-86	Gunsmith
	66	44-88	Plumber
	66	44-88	Pipefitter
	65	44-91	Lathe hand (production)
	65	43-91	Auto mechanic (general)
	65	43-91	Auto chauffeur
	65	42-89	Tailor

OCCUPATIONAL-INTELLIGENCE STANDARDS, *Continued*

INTELLIGENCE STANDARD INDEX: 96 OCCUPATIONAL DESIGNATIONS

Intelligence Group	Score Average	Score Range	Occupation
	65	44-88	Carpenter (bridge)
	64	43-88	Lineman
	63	40-89	Machinist (general)
	63	46-88	Motorcyclist
	63	41-86	Brakeman (railroad)
	62	31-94	Actor (vaudeville)
	61	40-85	Butcher
	61	44-84	Fireman (locomotive)
	61	39-82	Blacksmith (general)
	60	38-94	Shop mechanic (railroad)
	60	36-93	Printer
	60	40-84	Carpenter (general)
	59	40-87	Baker
	59	39-83	Mine drill runner
	59	38-81	Painter
	58	37-85	Concrete worker
	58	40-83	Farmer
	58	37-83	Truck driver
	58	37-82	Bricklayer
	57	41-81	Caterer
	57	39-71	Horse trainer
C	56	38-76	Cobbler
	55	35-81	Engineman (stationary)
	55	34-78	Barber
	55	35-77	Horse hostler
	52	38-96	Salesclerk
	52	33-74	Horse shoer
	51	31-79	Storekeeper (factory)
	51	26-77	Aeroplane worker
	51	31-74	Boilermaker
	50	33-75	Rigger
	50	30-72	Teamster
	49	40-71	Miner (general)
	48	21-89	Station agent (general)
	40	19-67	Hospital attendant
	40	19-60	Mason
	35	18-62	Lumberman
	35	19-57	Shoemaker
	32	16-59	Sailor
C —	31	20-62	Steel worker (structural)
	31	19-60	Canvas worker
	30	16-41	Leather worker
	27	19-63	Fireman (stationary)
	27	17-57	Cook
	26	18-60	Textile worker
	22	16-46	Sheet metal worker
	21	13-47	Laborer (construction)
D	20	15-51	Fisherman

camps. All these studies totaled approximately 60,000 cases and dealt with more than 115 different occupations.

Consideration has necessarily been made of the fact that these studies by the Division of Psychology were returns from draft quotas which were slightly inferior in intelligence on the average to the civilian population. This would indicate that occupational-intelligence standards derived from draft quotas would be slightly lower than should be expected normally. The selective service act further influenced these results secured from draft quotas in that of the seven-tenths of the men in the country between 21 and 31 who were given deferred classifications 6.8 per cent. of them received this deferment because they were skilled agricultural and industrial workers or highly specialized technical and mechanical experts. Undoubtedly these men were superior to the average intelligence for their occupation. Other factors influencing the exactness of the draft records as representative of a civilian standard were as follows: Probable exemptions of more men of high occupational skill than low occupational skill because of family dependents; prior enlistments of a higher mean intelligence than the civilian's population, which would have reduced the draft average; a lower rating of foreigners because of poor understanding of English than justified by their capacity; placing of students on record for clerical occupations; semi-skilled workers often classified as laborers, etc.

The correction process applied to this Army data was based upon a study of the records of over 3,598 personnel examinations made by the vocational department. Norms established by the Army studies have been verified, corrections applied, and additions made. The influences mentioned above have been considered in this correction process. It is thought now, however, with most of the records presented here that there is a tendency toward a slightly lower average than should be set for practical vocational purposes. Especially is this thought to be true with many of the mechanical occupations in the "C" and "C —" intelligence groups.

In the table given on pages 224-225 occupational-intelligence standards are listed for 96 occupational designations. These occupations are indexed numerically according to the average intelligence score. The score ratings are for Army Alpha and for "Business Alpha." The mean for the occupation is presented as the "score average," and the "score range," indicating the range of intelligence within which can be expected success in the occupation, secures its limits (usually, but not always) from the first and third quartile. The scores are so presented as to indicate that in all probability an individual must have an intelligence rating within

the "score range" for achievement in the occupation, with the further probability that he should be above the "score average" to be sure of sufficient intellectual capacity for the occupation.

4. *Special Ability and Interest Tests for Graduate Engineers*

B. V. Moore, "A Tested Method of Using Tests for Vocational Guidance," *School and Society*, 18:761-764 (1923)

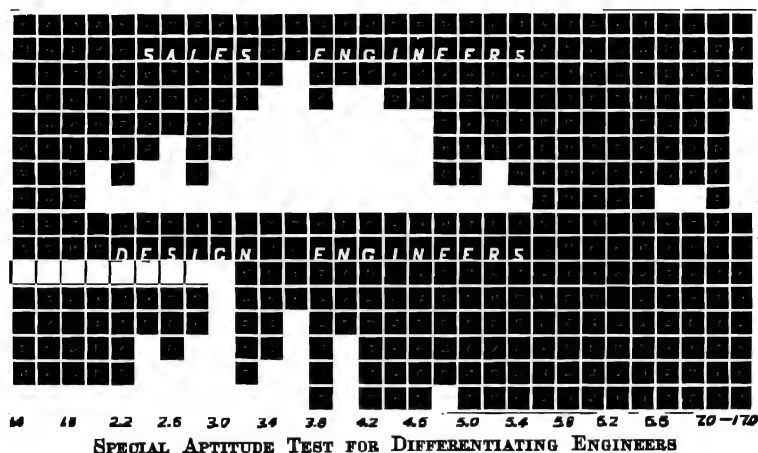
The Westinghouse Electric and Manufacturing Company each year employs about three hundred engineers who have just been graduated from technical schools and colleges. All these men have had practically the same training; but they must be differentiated and placed in different lines of engineering according to their special interests and aptitudes. The aim is not to discover which engineers are best for any particular kind of work; for a few very capable men might be best in all lines; but the aim is to discover in what line of work each engineer will function most efficiently and satisfactorily. The practical problem is to determine methods and means for selecting and placing young engineers in the type of work which they can do best.

Other means of differentiating these engineers having been evaluated and proven inadequate, a test to determine special capacities was constructed in two parts. Part I was to indicate sales capacity, and Part II was to indicate design engineering capacity. After this test had been tried out on other groups and revised several times, it was finally given to 30 design engineers and 59 sales engineers.

Now the practical purpose of the test is to separate the men who are to be sales engineers from those who are best fitted to be design engineers. A single score in a sales test or in an engineering test could not be relied upon to place the men; for the good all-around man would do best in both kinds of work and best in both kinds of tests. . . .

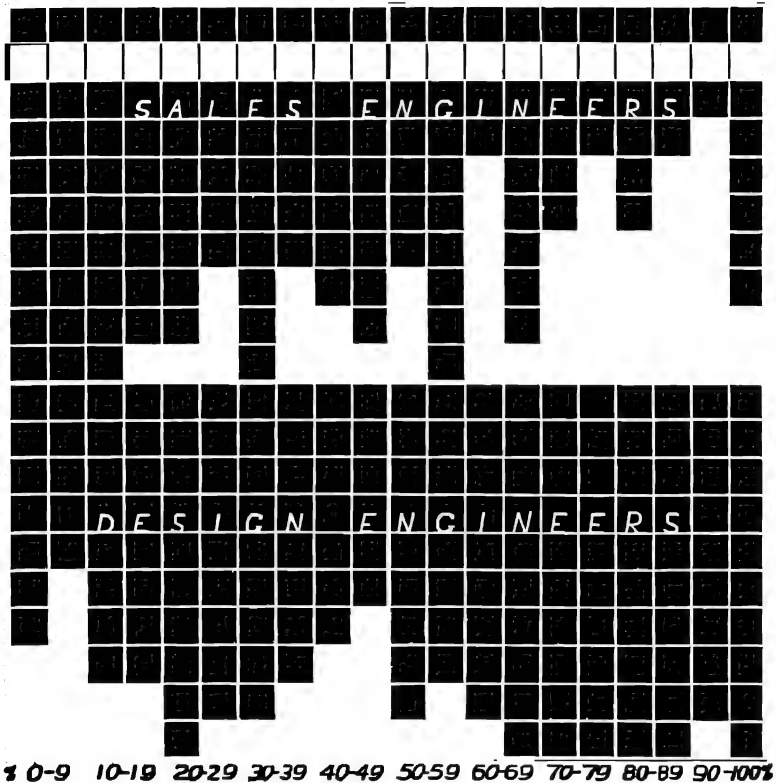
A still better method of dealing with two tests or two parts of a test to differentiate special capacity is to divide the score in Part I by the score in Part II for each individual. This is the method which is the simplest, and it is the one which gives the most efficient use of the test as a means of differentiating the men. This method magnifies the differences among the individuals which are indicated by the fact that the ability of each individual to deal with Part I differs from his ability to deal with Part II. That is, the ratio or quotient of a man's score in Part I divided by his score in Part II changes geometrically instead of algebraically as this man's special ability is greater or less. This probably makes

the results agree more nearly with the practical considerations; for the extreme cases of special ability should be markedly differentiated. The genius is valued probably far greater than an actual measurement of capacity on a linear scale would indicate. The results of dealing with the scores by this method are presented graphically in the figure below. Considering the diagram as a four-fold table, we have the engineers differentiated as follows:

SPECIAL APTITUDE TEST FOR DIFFERENTIATING ENGINEERS

Considering the diagram as a four-fold table, the engineers indicated by the test as sales engineers are 81 per cent correctly so classified; and the engineers indicated by the test as design engineers are 63 per cent correctly so classified. $r_u = +.70$.

Assuming that if an engineer's score in Part I of the test is more than 3.2 times his score in Part II, he is a sales engineer, and that if his score in Part I is less than 3.2 times his score in Part II, he is a design engineer or a pure type of engineer, this test divides the engineers so that 81 per cent of those above this critical ratio (Part I at least as much as 3.2 times Part II) are sales engineers; and 63 per cent of those below it are design engineers or of a purely engineering type. The correlation between the test results treated in this way and the actual classification of the men was $r_u = +.70$.

The previous practice has been to place the engineers according to their interests, but often the graduate engineers could not decide themselves what work they would prefer. A test or scale of interests was prepared to determine the ratio or per cent of interest in the various lines of work. The essential feature of this test was to request the subject to check a list of names of occupations with a plus or minus according as he would like to follow or

would not like to follow the various occupations. In various trials of this test, design engineers, sales engineers and insurance salesmen showed a definite tendency to like or be interested in occupations which in nature of work were similar to those occupations in which they were already successful. The kind of occupation

SCORES ON SPECIAL INTEREST TEST FOR ENGINEERS

Percentages of choices showing preference for occupations requiring sales type of person. Considering the diagram as a four-fold table, the interest test (Record of Interests) places correctly 82 per cent of the engineers. $r_u = .84$

which they thought would give them the greatest satisfaction to follow was a significant criterion of the kind of work in which they could be and were already successful. Assuming that we did not know the actual occupations of the engineers, those engineers which this test of interests alone would select for sales engineering, would be 89 per cent correctly placed or classified; and the men

which this test of interest selected for design engineering would be 69 per cent correctly placed or classified. This is shown graphically in the diagram on page 229.

The correlation between the results of the test of interests and the results of the test of special capacities is $r = +.50$. This tends to show not only that there is high correlation between interests and special ability, but also that the test of interests and the test of special capacity give reliable results.

During the two years following this first study in August, 1920, many additional graduate engineers have been tested as they were employed by the firm. Also, the later records or careers of the men tested have been followed up and checked against the predictions of the tests. Of 58 graduate engineers who took the test of interests in 1920 and 1921, the later assignment and success were followed up in May, 1922. This later check-up shows that this test of interests, alone, would have placed 85 per cent of these men in the line of work in which they are now successful.

We have the data on 121 graduate engineers who took the special engineering test, Parts I and II, in 1920 or 1921. This special ability test classified 68 per cent of the men as they were later segregated by the executives of the company after they had supervised the work of the engineers for a few months. We have been able to follow up the later success of 76 of these men; and we find that the test alone would have placed 74 per cent of these men in the line of work in which they are now successful. These two facts together, that is, the fact that the earlier classification of the men placed 68 per cent of the men in agreement with the predictions of the test, and the fact that a later classification placed 74 per cent of the men in agreement with the predictions of the test indicates that the accuracy of the test becomes more evident the longer the men have been at their work, and thus the more accurate the criterion of their success is. Several of the men had been released or had left the company. The data that we have indicate that those who left were more likely to be among those who were shown by the tests to be misplaced. We have record of only two men whose assignment had been changed from what it had been at first; but in both cases the change was from disagreement with the test of special capacity and the test of interests to agreement with the indications of these tests, although the indications of these tests were not the cause of the change of assignment.

There are 41 men, for whom we have criteria of later success, who were classified as sales engineers or as design engineers by both the test of special capacity and the test of interest. Thirty-

seven of these men, or 90 per cent were classified by both tests alike for the same work in which they are now successful.

5. *Guidance Based on Facts of the Whole Individual*

F. Gaw, L. Ramsey, M. Smith, W. Spielman, and C. Burt, *A Study in Vocational Guidance*, Report No. 33 of the Industrial Fatigue Research Board, 60-64, 81-89, 91, 95, 98 (His Majesty's Stationery Office, London, 1926)

. . . An effort was made to draw up a simple scheme for judging temperamental qualities. The following were the chief principles employed:

First, it was decided to begin with more elementary qualities of character, qualities which could be expressed in recognized psychological terms, and defined in recognized psychological language. The primary foundations of character are held to be the fundamental instincts and emotions. Hence, the first qualities to be judged in any given individual are the degrees to which these native tendencies are inherited and developed. To this end, the lists of primary emotions enumerated by McDougall and Shand were taken as a basis; and definitions were framed, briefly describing each of these emotional qualities in their various degrees.

It seemed questionable, however, whether these instinctive qualities in their simpler forms are of direct vocational importance. A supplementary list was, therefore, added, containing more complex characteristics, moral, social and temperamental, such as are commonly considered in giving vocational advice. The former qualities are for the most part inborn. The latter are for the most part acquired: they depend upon interests and sentiments, upon personal habits and ethical standards formed afresh by each person for himself during early life. Each of these secondary qualities was again defined in detail as before.

Finally, a rating-scale was framed which should facilitate measurements in numerical terms. The scale itself was not numerical. For each quality every child was to be marked with one of five letters—A, B, C, D, or E—according to the intensity with which the quality seemed developed in him; and the significance of the letters was defined in statistical terms. Plus and minus signs were to be freely used; so that, when the letters were eventually translated into numbers or marks, fifteen grades in all were theoretically distinguishable.

It was originally intended that, according to this schedule, each investigator should rate all the pupils tested at the schools selected

for the main research. Unfortunately, this proved too lengthy a task; to complete the entire list for every child would have consumed far more time than either children or investigators could spare. In these schools, therefore, the investigators contented themselves with recording only such outstanding characteristics as were noted in the course of their testing. To assess the reliability and accuracy of such judgments, a separate inquiry was necessary.

In this supplementary inquiry two groups of persons were made the subjects of a complete assessment according to the schedule. The first was a group of thirty, for the most part children about the school-leaving age, who came to the National Institute of Industrial Psychology for vocational guidance or for other reasons. Each of these persons was marked by at least two independent investigators for the character-qualities enumerated. The marks were based partly on observations made in the course of the testing, and partly on a brief interview, lasting from 10 to 30 minutes, specifically intended to elicit his temperamental characteristics.

The second was a smaller group of persons, chiefly young adults who were assessed in the same way by a number of psychologically trained observers, each of whom was already well acquainted with the persons to be judged. At the same time, one additional observer, to whom the person was not previously known, drew up a parallel assessment based simply upon a single personal interview, such as might be carried out for vocational guidance.

The data so obtained yield a provisional answer to two important questions. First, what is the "reliability" of impressionistic judgments formed by strangers during a first interview of this sort? How far, that is to say, do two independent observers, using such a method, agree with one another? Secondly, what is the accuracy of such judgments? How far, that is to say, do these impressionistic judgments correspond with the best opinion already available upon each of the persons judged? And, before this latter question can be answered, a third question must be asked: has this criterion itself a sufficiently high reliability to warrant its use as a control?

Table I gives reliability coefficients for the judgments on each of the qualities specified. The data are obtained from the first group of thirty children and young persons, all new to the observers. The coefficients measure the degree of correlation between the two independent observers, marking the same group of applicants after one short personal interview.

All the coefficients but one are more than three times the probable error. Their average is .57. The most striking thing, however, about the figures is the extraordinary range of divergence: for one of the qualities so marked the reliability is as high as .85, a

coefficient that would be thought extremely satisfactory even for a well-standardized test; for another quality it sinks to .23, a figure which has little or no significance as compared with the probable error. Plainly, therefore, so far as these results can be trusted, it must be far easier to reach consistent estimates for some qualities

TABLE I

RELIABILITY OF ESTIMATES OF CHARACTER QUALITIES

Qualities Estimated	Coefficient of Reliability	Probable Error
I. Simpler Qualities:		
1. Submissiveness	.85	±.04
2. Fear	.75	±.06
3. Assertiveness	.74	±.06
4. Sociability	.72	±.06
5. Anger	.71	±.07
6. Tenderness	.68	±.07
7. Cheerfulness	.60	±.09
8. Sorrow	.56	±.09
9. Sex	.51	±.10
10. Disgust	.42	±.11
11. Curiosity	.37	±.12
12. Acquisitiveness	.23	±.13
Average	.60	±.09
II. Secondary Qualities:		
1. Self-confidence	.77	±.06
2. Energy	.64	±.08
3. General emotionality	.62	±.08
4. Quickness	.61	±.08
5. Initiative	.57	±.09
6. Co-operation with superiors	.55	±.09
7. Industry	.54	±.10
8. Honesty	.52	±.10
9. Co-operation with equals	.50	±.10
10. Co-operation with inferiors	.49	±.10
11. Punctuality	.44	±.11
12. Reliability	.36	±.12
Average	.55	±.09

than for others; and it becomes of prime importance to discover what particular qualities can be so assessed with the greatest reliability, and which of them cannot be readily assessed in this manner at all.

(*i*) Generally speaking, it would seem that the simpler or primary qualities can be estimated with greater reliability than those

that have been termed secondary or complex. For this difference there are many obvious reasons; perhaps the most essential is that the names describing these qualities have now among psychologists a fairly well-organized connotation.

(*ii*) Among the primary qualities, those that are distinctly emotional are by far the most easy to assess. Acquisitiveness and curiosity, for example, instincts which have little or no accompanying emotion, yield estimates that are the least reliable in the whole list. The reason is evident; emotion is especially evoked in a personal interview, and, with younger people, at any rate, betrays itself directly by change of voice or facial expression.

(*iii*) Further, among these emotional qualities, those that are excited by human relations, such as naturally arise in all social situations, are the easiest to estimate of all. They have, in fact, high reliability coefficients rising usually to .70 or over. Whether the examinee's manner is sociable or timid, cheerful or bad-tempered, assertive or submissive, these are points which, in the same office and on the same day, are bound to impress different interviewers in much the same manner. It does not, of course, follow that where the candidate's momentary mood or disposition has prompted an identical estimate with independent judges, their judgments are, therefore, a true estimate of his permanent character. But it is clear that, unless they so agree, their judgments can have little worth.

(*iv*) Among what have been termed secondary or complex qualities, those that spontaneously emerge in test-performances appear to have the highest reliability—quickness, energy, initiative, self-confidence, and perhaps industry. These have all been classed with secondary qualities, on the ground that they are not included in the customary lists of primary emotions, but appear to be complex derivatives of several instinctive tendencies. Nevertheless, it is possible that nearly every one may be in fact an elementary quality of the mind. Quickness, for example, and energy, and general emotionality, have each been put forward by one writer or another as being in themselves based on some specific central factor. Among those that are undoubtedly complex, the differences in reliability are perhaps traceable to varying degrees in which they are actually called into play: the examinee's co-operativeness with superiors is naturally assessed more consistently than his degree of co-operation with equals or inferiors, since in most cases the candidate naturally looks upon his interviewer as his superior for the moment.

(*v*) Where the quality cannot be directly elicited in the course of an ordinary interview, and where the estimates have therefore to

be based on direct inference, there the reliability of the judgment is low—for example, punctuality.

(*vi*) Where the quality to be assessed is a moral quality rather than a temperamental one, and where an extreme manifestation of it (or of its opposite) constitutes an anti-social, unmannerly, or even criminal trait, there, naturally enough, its expression may be successfully concealed, and an estimate of its amount can seldom be relied upon. Thus judgments for honesty, reliability, and sex, yield decidedly low coefficients; and those for inquisitiveness and acquisitiveness yield coefficients poorer still. . . .

Methods of giving advice.—When all tests had been given, the results worked out, and the home visiting concluded, the investigators met to discuss the occupation to be recommended to each child. Notes were made on each of the one hundred children tested, summarizing their performances in the tests . . . and combining the personal impressions of each investigator and the inferences from the home conditions. The problem then was to decide what occupation seemed most nearly suited to the abilities and temperament of each one, so far as it had been possible to ascertain them by tests and personal observation.

In its general lines the procedure adopted was based on that worked out by Professor Burtt and his colleagues at the Vocational section of the National Institute. He has described it as a method of "progressive delimitation." Starting first of all with the factor that seems the most general and therefore the most widely influential, and then proceeding step by step to so-called group-factors, and ultimately to factors quite specific, whole classes of unsuitable occupations are gradually eliminated and the choice in the end is narrowed down to one or two particular types of employment.

Thus, broadly speaking, the final decision is reached through three or four distinguishable stages:

(*i*) Every child was classified, first of all, according to the general level of his native intelligence. For this our main guide was the child's mental ratio in the Binet tests, averaged with or adjusted by his mental ratio in the Performance tests, and at times corrected in accordance with the statements of teachers and parents, and the personal impressions gained during our interview. He could then be placed in one of eight classes. This at once limited the scope of reasonable choice. The alternatives open to him were reduced by four-fifths. Instead of the one hundred or more different types of work enumerated in an occupational table, we now had to choose at the outside between twenty or twenty-five.

(*ii*) The child was next considered from three points of view: (*a*) his verbal or linguistic ability as shown by his achievements

in the Binet tests and in the tests of scholastic attainment; (*b*) his practical or non-verbal ability, as shown by his achievements in the Performance tests, supplemented by reports on his handwork and on his common sense in the practical affairs of everyday life; (*c*) his social ability—ability to get on with others—as reported by teachers and parents and assessed in the personal interview. From each of these three points of view the children were then sub-classified, and each was tentatively allocated to a corresponding occupational group.

(*iii*) At this stage certain more specific factors were brought forward, as likely to limit still further the final recommendation. Of these the more important may again be sub-divided into four groups:

1. Special Abilities: for example, those needed in scholastic or in manual and mechanical work, or in dressmaking; or, again, such specific capacities as may be loosely summed up in the terms memory or imagination.
2. Special Temperamental Qualities: using the term temperamental in a broad generic sense (for example, happy or unhappy disposition, choleric or phlegmatic moods) and including such personal qualities as originality or initiative, and such miscellaneous points as the child's special interests.
3. Physical Conditions: whether of a positive or negative implication.
4. Home Conditions: with special reference to the immediate need for remunerative employment, the parents' wishes for the child's future, and the openings accessible in the neighbourhood.

(*iv*) In a majority of cases, it was found that these successive considerations converged ultimately upon a single kind of employment as being the only one consistent with the child's individual requirements, with perhaps two or three alternatives in an order of diminishing suitability. The problem in its final stage resembled one of vocational selection rather than of vocational guidance. Assuming, as it were, that the child has become an applicant for the employment thus indicated, the psychologist proceeds to analyse the candidate's suitability from this new standpoint. He can now, if necessary, apply special selection-tests for that occupation, or re-investigate in greater detail the child's power to meet all the needs of the occupation proposed. Thus, without applying all the selection-tests to all the individuals, the fitness of each one for whatever has been suggested can be checked and verified, and the final recommendation can be confirmed. . . .

The children falling into the three subordinate groups, marked by high development of some one special quality—linguistic, practical, or social—deserve illustration here at somewhat greater length. The following are typical cases:

(*a*) Those children who fell in the top half of group A and who were not particularly high in group B or C (i.e., those who were distinguished only by a marked degree of linguistic intelligence) were, as a rule, recommended to take up clerical work, always provided that they had reached a sufficiently high scholastic standard and were not unsuited by temperament to a sedentary life.

A. B., for example had a mental ratio in the Binet tests of 121, but only reached 87 in the non-linguistic tests. Of the 24 girls who were tested in her school, she ranked 4th in speed of arithmetic, 8th in oral arithmetic, 5th in speed of writing, and 8th in spelling. Her social qualities were not well developed; she found it difficult to make friends, was not interested in playing with other children, but preferred to read at home; she was reserved and quiet. She was advised to take up office work, and to attend classes in book-keeping and accountancy.

(*b*) Those falling in the top half of the second group, B (i.e., those of marked non-linguistic abilities) were advised to take up a skilled trade, the particular trade recommended depending upon special abilities, temperamental factors and home facilities.

For example, C. D. had a mental ratio of 112 in the performance tests, and a mental ratio of 85 in the Binet tests. She was good at the dressmaking tests, and was anxious to enter that trade. She was recommended to do so.

E. F. had a mental ratio of 97 in the performance tests, and of 78 in the Binet tests. He was an imaginative boy, but rather shy, and did not get on particularly well with others. His scholastic standard was low. He was, however, interested in work with his hands such as carpentry, and showed some constructive ability. He was advised to take up cabinet-making.

(*c*) Those belonging to the top grade of group C (i.e., those who showed a marked degree of social ability and were likely to be particularly successful in dealing with people) were advised, in most cases, to take up some kind of employment where this gift would not be wasted, even if they were in other respects fitted for clerical work or the skilled trades. Of the girls of moderate ability, many were advised to be shop assistants or waitresses; and of the boys several were advised to become shop assistants, waiters, or 'bus conductors.

G. H. had a mental ratio of 117 in the Binet tests and 108 in the performance tests. She had imagination and very good constructive ability. She might have been advised to take up clerical work; but her scholastic standard was not particularly high, and her personal qualities—a good appearance and good manner and a

capacity for "getting on" with people—added to the fact that she was not interested in "bookish" things, seemed to indicate that she would be more successful as a shop assistant, particularly if she were placed with a progressive firm giving her a chance to gain a good position.

J. K. had a mental ratio of 96 in the Binet tests and 100 in the performance tests. He was rather small and childish for his age, good looking and with good manners. He was energetic, bright, and inclined to be sprightly and even mischievous. He was advised to start as a page boy in a big hotel.

There were several cases less well-marked, who fell in the lower half of each group, but who at the same time, showed more ability in one group than in either of the other two.

Those whose linguistic side was most predominant, but nevertheless not highly developed, were recommended for the lower branches of clerical work, such as that of a stock room clerk or goods checker. Those showing moderate non-linguistic abilities were advised to take up factory work or packing, the latter especially if they showed any ability in judging form relations.

Those who possessed social abilities and were willing and good-natured, but were not remarkable for intelligence as estimated by the tests, were considered suitable for such occupations as house boy, assistant in a small shop, etc.

The following table illustrates the recommendations made in accordance with these principles:

OCCUPATION RECOMMENDED ACCORDING TO ANALYSIS OF ABILITY

	A. Linguistic Ability	B. Non-Linguistic Ability	C. Social Ability
High Intelligence	Clerical work of superior type (e.g., bank-clerk, if combined with arithmetical ability; shorthand and typing or secretarial work, if combined with literary and spelling ability)	Skilled trades (engineering, instrument-making, cabinet-making for boys; dress-making, millinery for girls)	Show-room assistant or shop-assistant in good West-end firms, waiter or waitress in better class establishments, domestic service in households of the best type
Moderate Intelligence	Routine typing; checking in warehouse or stockroom	Unskilled manual work (factory work, packing)	Shop assistant (in smaller shops), house boy, page boy, nursemaid, domestic service generally

When occupations had been suggested for the children who could be placed in the groups just described, there still remained a few who, for one reason or another, could not be placed in any of these groups, children in whose case the accessory factors enumerated above were more important than the primary considerations of linguistic and non-linguistic intelligence and social ability.

Such cases are more frequent than might at first be thought. . . . These special cases (so far as we encountered them) may be divided into four types. The outstanding characteristics of each were as follows:

1. Marked special ability, or peculiar talent.
2. High all round ability, with social handicaps at home.
3. Low general ability, not amounting to mental deficiency, but often aggravated by poor physique, and uncompensated by any special aptitude or qualification.
4. Special temperamental difficulties. . . .

Finally, a letter was sent to each of the parents stating the occupation primarily recommended, with, in most cases, one or two alternative suggestions. The chief reasons for each recommendation were given in brief and simple terms; and the letter was intended to be used as a reference if so desired. Below is a specimen copy of a letter. (The portion here printed in roman types was printed on the form, and the part here printed in italics was filled in for each child.) Several replies to these letters were received, either asking for employment, or saying that the work recommended had been found and thanking us for the advice.

THE INDUSTRIAL FATIGUE RESEARCH BOARD | THE NATIONAL INSTITUTE OF INDUSTRIAL PSYCHOLOGY

Dear Mrs. (Brown),

I think you already know that a set of special tests have been given to the children leaving M.——— St. school, with the object of finding out the work for which they are best suited.

The results of these tests suggest that your son *James* would be likely to do well at *Electrical Engineering or Motor Engineering.*

He has *good average* intelligence and all round ability: but is, on the whole, best at *mechanical things.* He is *careful and deliberate.*

His writing, spelling and arithmetic are not up to the standard required for office work. He will do much better on the practical side where he has plenty of ability and should make good progress.

I shall be very much interested to hear later on how *James* is getting on.

If this letter is of any use to you as a recommendation, please use it as such.

Yours faithfully,

L. C. RAMSEY

In forty-seven cases out of the 100 a different employment was recommended from that originally suggested by the parents or (in a few cases) by the teachers; in thirty-five cases the employment recommended was the same; in fifteen cases the parents had had no suggestion to offer; in three cases the parents' wishes were unknown.

It will be seen that, in a large proportion of the cases, the recommendations made by the investigators appeared to coincide with the suggestions of the parent or the teacher. It may be asked, therefore, what special advantage is reaped by a prolonged psychological study of each individual child.

A review of our detailed results shows that, even where our views were in agreement with those of parent or teacher, the parent and often the teacher in the opinions they expressed were apt to be more general and vague; the tests and the intensive examination, on the other hand, lead to suggestions that are quite specific. A teacher, for example, will recommend the child for 'manual work' or for 'clerical work,' without further particularization; while our own investigation would commonly show that it was only for certain special types of such work that the child was really suited. The teachers' recommendations seemed implicitly to assume some form of faculty psychology, and to ignore both the very limited character of specific abilities, and the supreme importance and the wide range of general intelligence. Further, we were able to give in order of preference two or three distinct recommendations; so that, if one type of occupation proved inaccessible owing to the temporary conditions of the trade, a different one might conceivably be taken up.

Where our opinion differed from that of the teacher or parent, it was a great advantage to be able to produce the child's test records and specimens of his actual work. The teacher was usually open to persuasion by a mere statement of results; but the parent was often more obdurate—sometimes hoping against all reason that his child would succeed in some high-class, well-paid branch of employment. Nothing but a display of the child's actual performances, side by side with standard results, would convince such a parent that his child was (to quote actual cases) a hopeless misspeller, or had no skill of any commercial value in sewing, drawing, or calculation. Provided our unfavorable conclusion did not seem to him to be mere opinion, and that we had in addition a positive suggestion of our own, the parent always proved grateful for our contribution to the problem. Thus, in nearly every case of divergence, we were ultimately able to carry conviction with both parents and teachers, who might otherwise, for quite irrelevant

reasons, have urged the child to go into some employment, which seemed superficially attractive but for which the child was really unfit.

In all these discussions and recommendations we found oursèlves labouring under one great disadvantage. Hardly any accurate information exists as to the real needs of the occupations open to young people. We could produce a detailed psychological description of each child; but we had no such psychological description of his prospective employment to compare with it. Some of us, indeed, had enjoyed a first-hand experience of the conditions in large firms and business-houses employing boys and girls fresh from the schoolroom; but it is obvious that no one group of advisers could possibly have a close acquaintance with trades and businesses of every type. What personal knowledge we ourselves possessed could, indeed, always be supplemented by the information readily obtainable from officials of the care committee or of the employment exchange; and for occupations of a less familiar type we could refer to the numerous handbooks and reports issued by the Board of Trade, by the Ministry of Labour, or by private publishers. Nevertheless, time after time, when we were discussing the placement of a particular child, we found that the point most commonly in dispute was not so much the needs of the child himself as the needs of the employment to which it was proposed to send him. What is known as job-analysis, therefore, is one of the most urgent lines of research to be undertaken before vocational guidance can be placed upon a sound footing. . . .

In the long run, the value of any scheme of vocational guidance can be determined only by following up the after-careers of the children examined. Is there any evidence that the boys and girls who were tested psychologically, and whose choice of employment was guided by the tests, are themselves better satisfied with the occupations they have entered than those who found employment in the ordinary way? Do they, after actual trial, find the work congenial—better suited to their aptitudes and more accordant with their interests? Are they more efficient at it? Do they give greater satisfaction to their employers? Have they in front of them a better prospect than they would have had without the special aid and advice? These, after all, are the crucial issues. . . .

With this object in view, the homes were all revisited in November, 1925—two years after the date of our original recommendations. The ages of the children now lay between sixteen and sixteen and a halt. Sufficient time had passed for almost all to find situations, and to learn whether they liked such work as they had secured.

So far as possible, the following points were ascertained for each child: (*i*) present employment; (*ii*) previous employment or employments, if any; (*iii*) wages; (*iv*) prospects; (*v*) satisfaction or dissatisfaction with present and past employments; (*vi*) reasons for changes. The distribution of these various cases, grouped according to their success in finding employment of the type advised, is shown in the table below.

CLASSIFICATION OF CHILDREN ACCORDING TO EMPLOYMENT OBTAINED

	A. In Employment Recommended	B. In Employment Similar to That Recommended	C. In Employment Dissimilar to That Recommended	Total	Percentage [A and B Together, Excluding (4)]	Percentage [C Excluding (4)]
1. Satisfied with work, pay and prospects .	22	19	13	54	83.6	39.4
2. Satisfied with work, but not with pay or prospects	7	0	6	13	14.3	18.2
3. Dissatisfied with work.	0	1	14	15	2.1	42.4
4. Insufficient information	1	2	7	10	...	...
Total	30	22	40	92	100.0	100.0

The general outcome of the inquiry speaks strongly in favour of the methods used. The scheme has proved workable; the results, unexpectedly successful. Judged by the after-histories of the several children, those who entered occupations of the kind recommended have proved both efficient and contented in their work. As compared with their fellows, they are, on an average, in receipt of higher pay; they have generally obtained promotion earlier; they have experienced fewer changes of situation; and have incurred hardly a single dismissal between them. Over 80 per cent declare themselves satisfied alike with the work they have taken and with their prospects and their pay. On the other hand, of those who obtained employment different from the kind advised, less than 40 per cent are satisfied. Among the latter group nearly half dislike their work; and among the former only one dislikes it, and that simply because it is not quite identical with what was originally advised. As has been pointed out above, no great weight can be attached to these figures; yet, so far as they go, they are certainly encouraging.

QUESTIONS

1. List in order of importance all the motives you can identify which affected your choice of an occupation. If you are a student with your career as yet unselected, give the reasons why you came to your particular institution. Try to specify fundamental impulses and avoid the pitfalls of rationalization. Is this a difficult or easy task?
2. What dominant urges are satisfied by each of the points of a good job? Which of these are instincts? What other points of a good job can you add?

CHAPTER IX

TRAINING THE WORKER

With the universal prevalence of subdivided work, most industrial jobs can be learned within periods ranging from a few days to a few weeks. Running a punch press, assembling a motor, or building a transformer are all operations in which the peak of performance is reached in a surprisingly short time. The interests of efficiency demand that the employees learn to work at a high level of excellence with the briefest amount of training.

A problem such as this resembles closely the issues which educational psychology tries to meet in the school. Economical procedures of learning have been determined by experimentalists in this field so that the question as to what constitutes a good or poor method of instruction can be settled objectively. Method A is superior to Method B if in the same time interval the workmen trained under it achieve a greater efficiency.

The importance of good teaching in industrial affairs has not been sufficiently appreciated. The far-sighted plans and high ambitions of the managerial staff are of little avail unless they can be communicated to the individual workman for translation into action. Men adhere to old ways from habit, even when the new are demonstrably better. Much of the friction which scientific management schemes have unnecessarily produced could have been avoided by a careful system of instruction. Taylor's shop management scheme did provide for instructional cards to be used under the supervision of an expert, but few plants adopted this method because of its association with a multitude of other bosses. The best arrangement for attaining the pedagogical aims of the company seems to be some sort of vestibule school, preferably administered by the educational section of the personnel department. The curriculum, the material equipment of instruction, and the teaching staff should be adopted with the same care that a progressive city school system attacks corresponding problems.

A. Organization of Industrial Education

1. *Objectives in Industrial Training*

H. C. LINK, *Education and Industry*, 12-14 (The Macmillan Co., 1923)

Ability, interest, and good-will, which it is the function of the company's educational program to cultivate, are closely interwoven qualities. Still, it is possible for an employee to have any one of them without having the others. A worker may be skilled for example, without being interested in his job or without feeling good-will toward his employer. He may be interested without possessing skill. The possible separation of these three qualities has therefore led to a corresponding separation of functions and emphasis in the educational activities of industries.

1. *Ability.*—The chief emphasis in the older forms of company training was on occupational ability. What is probably the first company school in the country, the Brown and Sharp apprentice course, was aimed specifically at the development of toolmakers and machinists. This apprentice school was followed by many others in the same field, and for years, this kind of training predominated in industry. There are now many other kinds of education and training calculated to develop ability in a specific task, such as vestibule schools, foremen's classes, classes for salesmen, and others. Not only has the development of ability received most attention in industries, but most literature on industrial education has also dealt with this particular phase of the subject. Unquestionably to increase the ability of the individual worker in his occupation is the first educational task which confronts industry.

2. *Arousing Interest in Work.*—However, the extreme subdivision of labor has brought about many tasks which require so little ability that they may be learned in only a few weeks' time. The actions of a worker at such a task become automatic and leave nothing to stimulate his imagination or interest in his work. Companies realizing the serious consequences arising from an uninterested state of mind are making strenuous efforts to arouse the interest of their workers in every way possible. Notable among these efforts is the work of Robert B. Wolf who in the Spanish River Pulp and Paper Company, attempted to arouse interest by giving his employees supplementary information about their jobs in such fashion that they could not perform their tasks without constant mental exertion. Many companies try to arouse the interest of their employees by showing them the relation of their particular task to the processes of the company as a whole. Cer-

tainly if a company is to enlist the best possible interest of its employees, it cannot be satisfied with the merely physical, automatic efforts which go into the accomplishment of a task day in and day out. And so long as such tasks are a part of the industrial system, companies are justified in attempting to mitigate their bad results in any way possible.

3. *Good-Will.*—Good-will is also bound up closely with ability and interest and yet it is sufficiently distinct so that employers can direct their endeavors specifically toward its development. . . . The importance which employers now attach to good-will on the part of their employees has long been foreshadowed in the value which they have placed upon the good-will of the public whom they serve. The two are inseparable; for it is almost impossible for a company to maintain the good-will of its patrons without a service or a product which embodies the good-will of the employees behind it.

Another aspect of the cultivation of good-will is seen in the emphasis which many companies are placing today upon the so-called *institutional spirit.* Institutional spirit is a synonym for good-will. In their emphasis upon institutional spirit industries are acknowledging that the development of ability and skill alone leaves out of consideration the very foundation upon which skill and ability may be continuously improved. To be sure, good-will or an institutional spirit cannot be established by education alone, for it is a composite of many influences. It can be cultivated only by a thoroughgoing observation of all the elements that enter into good industrial relations.

2. *Breaking in the New Man*

G. L. Gardiner, *Practical Foremanship*, 112-116 (McGraw-Hill, 1925)

New men are bound to be expensive. How expensive they are depends largely upon how they are broken in on the jobs.

If a new man is left to himself to "pick up" his job as best he can with little instruction from the foreman, he will be a very expensive man for the company. A new man will cost the least when he is carefully broken in and taught to do his work the right way first.

Unless a new man is carefully instructed, he will spoil a great deal of material. Spoiled material means not only a waste of material but also a waste of time. Wasted material and wasted time cost a company dollars and cents. To put a green man at a job without spending some time teaching him the *one best way* to do the job is just as foolish as throwing money out of the window.

The time to impress a man with the importance of quality work-

manship is when he starts to work. Quality should be put ahead of quantity because he should first learn to do his work right. Speed will come with practice. Speed without quality is expensive.

A green man was sent in to the foreman in a furniture factory. "Take this sandpaper and rub that varnish down to a smooth finish on those ten tables. When you get done with that job, look me up." These were the foreman's instructions to the new man.

Several hours later the new man hunted the foreman up and reported that he had finished the job. Imagine how shocked the foreman was when he found that the man had ruined the finish on the tables by sanding clear through the preliminary coats to the bare wood. In a few hours the green man had undone the work of many hours by skilled men. The foreman took the man to task because he had not asked questions before he started. But the foreman had no one to blame but himself. He did not take the pains to break the new man in right.

It is a well-known fact that *accidents are more apt to happen to a new man* than to a man who is experienced.

Accidents to new men can be largely avoided if the men are carefully instructed regarding the dangerous points of the work they are undertaking. It is almost a crime for a foreman to allow a new man to start in on a job that is dangerous without warning him and telling him how to avoid accidents.

The maintenance foreman in a paper mill hired a young man as a helper. About the middle of the afternoon of the first day on the job, the foreman called the new man and said, "Osborne, run over to the power house and pull the switch on the main line. Then come back here, I've got a little job for you."

Half an hour passed, but Osborne did not return. The foreman went over to the power house to get him. To his horror he found Osborne unconscious on the floor in front of the switchboard, with one hand burned to a crisp—useless for life.

Perhaps the switchboard should have been "foolproof," but it was not. This foreman had not instructed the new man regarding the dangers of his job. . . .

Labor turnover is highest among new men. A man is the most apt to quit during the first few weeks he is on a job. A job always looks more difficult and less attractive to anyone while he is getting acquainted with it. When a man first comes on a job, there are many things he must get used to. He feels strange and out of place. He does not know the men around him. He is not acquainted with the rules and regulations of the shop, and he is in constant fear that he will do something he should not do. He

feels clumsy and awkward. He is a "rookie," and he is apt to feel "like a fish out of water."

When a man is in this uncomfortable stage, it does not take much to discourage him. If no one seems to take any interest in helping him along, he may become dissatisfied and quit without giving the job a fair trial. The foreman has a wonderful chance to "make a hit" with such a man by handling him in a kind and courteous manner. . . .

A foreman usually earns or loses the loyalty of his men by the way he treats them while they are green, at the time when they are hungry for a friend.

First impressions mean more to us than we realize. The first impression a new man gets is apt to stay with him. He not only sizes up the foreman when he starts work, but he passes judgment on the company by the treatment he gets. A foreman can greatly reduce his labor turnover by taking a friendly, helpful attitude toward the new employee when he enters his department.

The foreman should realize that he holds the reputation of the company at stake because the company is judged by its representatives. The foreman is the representative of the company in the shop.

3. *The Sponsor System*

W. D. SCOTT, R. C. CLOTHIER, and S. B. MATHEWSON, *Personnel Management*, rev. ed., 317-318 (McGraw-Hill, 1931)

Many business institutions maintain a staff of employees of the proper personality and viewpoint, one or two in each department, who assume the responsibility outside their own work of looking after the new employees in their departments. In certain department stores, for instance, these persons are called Sponsors and are organized into Sponsors' Associations to which it is held an honor to belong. The name of the new employee is sent, usually through the department head, to the Sponsor in the department in which he is to work, and sometime during the first morning or at the beginning of the first lunch hour the Sponsor introduces himself to the new employee and volunteers to escort him to the lunch room, to show him around the building, to indicate where the toilet facilities are located, to offer him that companionship without which the new employee may feel considerably at a loss. The need for choosing Sponsors of the right kind of personality and ability in this consideration of their duties is apparent. It is the usual practice to grant Sponsors extra pay in addition to their regular wage for these added duties. The investment here is slight,

but the yield in terms of success in bridging this earlier period of doubt and depression on the part of the new employee is great.

4. *The Vestibule School*

H. E. Burtt, *Psychology and Industrial Efficiency* (modified), 54-57 (Appleton, 1929)

Instead of instructing the new worker on the actual job, some concerns find it profitable to conduct a vestibule school. This involves establishing a place in which there are duplicates of certain machines used in the factory or office by means of which the worker is instructed under careful supervision.

This scheme has several advantages. In the first place it makes possible a wiser and more far-sighted placement of the worker. It may be feasible in the vestibule school to try him out at various machines and determine to which he is best adapted. In the present status of employment methods, it is not possible to detect all the capacities that fit one more or less adequately for a given job. In the vestibule school, however, the worker may himself find that he likes some kinds of work better than others. This would not be feasible under actual factory conditions because he would be less closely observed and have less varied opportunities. The supervisor in the school is definitely on the lookout for such things. Furthermore, it is sometimes possible in the school to get a line on various other qualities besides actual ability. Such a thing as impatience at a routine job, or unwillingness to co-operate, or emotional instability which might not be manifest in the usual induction procedure would show up in the vestibule school.

A second advantage of the vestibule school and perhaps its greatest is that it affords better instruction. If the worker starts under the supervision of a foreman the emphasis is usually more on his production than on the manner in which he is doing the job. In the vestibule school, on the other hand, the supervisor or teacher has as his main goal the instruction of the worker and production is secondary. He may stress accuracy in the initial stages of learning and consequently bring the worker to an ultimately higher level, whereas a foreman may urge the man to speed and thus get him into a lot of inaccurate working habits. So the vestibule school facilitates this better instruction by providing skillful supervision by persons specially trained and equipped for that one task. Incidentally the new man can turn to his instructor with confidence and need not be on his guard against shop tricks—left-handed monkey wrenches and the like.

The vestibule school also makes possible a more adequate check

on the employee's progress which is often lacking in the factory. If we consider for a moment the average schoolroom procedure, the teacher gives some instruction, then gives tests or examinations to determine the strong or weak points, and then governs the subsequent instruction accordingly. Similarly, in vestibule schools it is possible to keep a rather detailed record of the worker's progress, perhaps by means of simple job tests, such as periodic tests in operating a computing machine. These periodic checks upon progress indicate the weak spots where additional instruction is needed and make for much more efficient progress in learning.

In many organizations, the vestibule serves as a safety valve so that, when work is slack, instead of discharging employees they may be put into the vestibule school and given further instruction. For instance, in an office in a dull period a number of the girls were put into this school and taught to perform other operations than the one which they normally performed in the office. This made for a more flexible organization. If some of the employees were capable of using half a dozen different types of office machinery or of performing various operations it is obvious that in a rush period they could be shifted around according to the peak load. Such a flexible organization could naturally rise to an emergency better than one in which each individual knew only one thing. Another factory during slack periods gave special training to some employees who would otherwise have been laid off, but paid them 80 per cent of their normal rate. In this way the school served to keep efficient employees on the pay roll so that they would be available later when badly needed, and their retention during the dull period was not a total loss because they were thus becoming of more all-round value to the company.

Another advantage of the vestibule school might perhaps be mentioned. It serves to break in new employees without a sudden plunge into the factory atmosphere. Some persons are rather socially sensitive if more proficient individuals are observing their mistakes, whereas in the vestibule school atmosphere mistakes are to be expected and the worker does not feel any timidity for this reason.

5. *Instruction via the Pay Envelope*

H. C. Link, *Education and Industry*, 98-100 (The Macmillan Co., 1923)

Employers believe that the pay envelope is a strategic means of commanding the attention of their employees. Even where wages are above criticism, the pay envelope is by all means the most sensitive of all points of contact between employer and employee. For that very reason, its misuse may have the most disastrous consequences. It is unnecessary to go into the refinements of the

psychology of the employee to discover what some of these misuses can be. A common sense analysis or a mere consideration of the elements of good taste will suffice. For instance, almost any individual, upon being paid for services which he considers adequate, would resent a remark which implied that his services had not been worth the money; or which suggested that greater industry and loyalty would increase his remuneration. It can hardly be considered good taste to inclose, with the pay envelope, a set of instructions or suggestions as to how its contents shall be used. In the ordinary business transactions of the day, we should certainly abhor giving or receiving with every payment, a little sermon on thrift, loyalty, patience, and other highly moral qualities. . . . The pay envelope represents a purely mechanical business transaction, and as such should be treated with the restraint and dignity which accompany all other impersonal money transactions. By accompanying the pay envelope with a personal or paternalistic preachment, the employer is more than likely to arouse in the mind of its recipient a sense of the inadequacy of its contents.

B. Economical Methods of Instruction

6. *Training on the Job*

C. R. ALLEN, *The Instructor, the Man and the Job*, 23-25 (J. B. Lippincott Co., 1919); reprinted by permission

Whenever practical training is undertaken, it is generally carried on according to one of two methods which for convenience may be designated as training on the job and training by exercises. Whatever the details in training on the job, the learner, from the beginning, is put directly on actual work. Production starts as soon as training starts. From the beginning of his training, the learner uses the same tools and machines and works up the same stock as would a regular producer on that job. He turns out a product that is of value, although, of course, his productivity is not so great.

In training by exercises, the learner is not put on actual work from the start. Production does not start when training begins but there is a period during which the learner does not produce in the sense that his product is of value. It may be true, that, by the exercise method of training, the learner may use the same tools and machines, or even work on the same stock as a regular man on the job, but his product is not used. It is "junked," or dissembled after it has served its training purpose. The test for an "exercise" is therefore not how the job is done but what becomes of the product after the job is done. . . .

Theory of the Two Methods.—The exercise method is based upon the theory that a learner must, in some way, secure a certain amount of skill before he can be trusted on actual work. Unless he has acquired this skill he will spoil work, damage machines, spoil jobs. In certain cases, in training for skilled trades, it is also based on the theory that if a learner can be given skill in a series of disconnected operations he can, later, readily combine any set of those operations into the doing of any given job.

The method of training on production is based on the theory that, under proper conditions, the "non-productive period" is unnecessary, in the great majority of cases. The greater interest of the learner, the value of his product, the added training value to learners in working under actual working conditions more than offsets the chances of the small amount of spoiled work that results where this type of training is carried on under proper conditions.

Since most men in industrial plants have not known how to secure proper conditions and have sensed the dangers of the "jobs" method of training, it is not surprising that they have tried the exercise method to a greater or less extent.

7. *Teaching "The One Best Way"*

F. B. GILBRETH, *Motion Study*, 37 (Van Nostrand, 1911)

The best results from a motion-study standpoint can be attained only by teaching the apprentice from his first day to lay the brick with the standard motions regardless of the looks of the work. If the work is not good enough to permit the brick to remain on the wall, a skilled bricklayer should fix it, until the apprentice can lay the brick with the prescribed standard motions in a manner good enough to permit the work to remain as a part of the structure.

The apprentice should not be permitted to depart from the standard motions in any case until he has first acquired them as a fixed habit. The most pernicious practice is the generally accepted one of first having an apprentice do perfect work and then attempting to make speed later. The right motions should be taught first, and the work taken down and rebuilt until it is up to standard quality. This is the *only* way to get the full benefits of the economics of motion study.

8. *Speed versus Accuracy*

MARY STUART, "A Comparison of Speed with Accuracy in the Learning Process," *British Journal of Psychology*, 12:297-300 (1921)

It is perfectly clear that so far as typewriting is concerned Gilbreth is wrong in his contention that learning motions slowly

is no help to the making of them quickly after they are learnt. The rate at which a beginner *is allowed* to work need make no difference whatever to the rate at which he *can* work after a certain amount of practice. When required, children who for six months have been allowed to work as slowly as they like, can acquire the speed of a group that has been exhorted from the beginning to work as fast as possible. The improvement is immediate, and the records of the two groups remain to the end so similar that they may be considered identical.

It is nearly as clear that the talk about the deplorable results of 'careless haste' is equally unfounded. Children who have been making over eighty mistakes in a page of typing, can, in the course of three lessons, reduce them to nine, and that with only the very smallest decrease in speed. But, at the same time, it must be noted that accuracy will not improve of itself as speed will. The group that was trained in accuracy gradually improved in speed: but the group that was trained in speed did not constantly improve in accuracy—on the contrary, after an initial improvement it gradually became less accurate. . . .

Certain features of the experiment illustrate serious difficulties in the way of carrying out Gilbreth's suggestion, even if his general contentions were correct. He assumes that before beginning to teach habits involving (or consisting of) muscular activity, the best motions have been discovered and motion models set up. In typewriting, at all events, owing to the large number of combinations of movements, the latter is impossible, and, from this experiment, it seems unlikely that the same movements are desirable for all individuals; e.g., many of the children seemed unable, through weakness, to use the little finger of the left hand. Moreover, many of the children seemed to find great difficulty in learning to make, or to omit to make, some particular movement. In the speed group this difficulty was more noticeable than in the accuracy group, apparently because the effort to work fast prevented them from paying adequate attention to the details of their movement. Near the end of the experiment, notes were taken of the fingering and the position of the hands of the children; of the four who were best, three came from the accuracy group, and of the four worst, three were from the speed group. On the average too, the movements of the accuracy group were considerably more 'correct.' This result is only what might be expected in learning a habit involving varied and difficult movements. Unless some extremely stringent system of discipline is in use, it is impossible, if speed is demanded from the start, to insure absolute correctness of movement. Of course,

the value of 'correctness' of movement is uncertain; but it would probably appear in advanced stages of practice.

Conclusions.—1. If movements such as are employed in typewriting are learnt slowly at first, the length of the learning process is not thereby increased; and it appears highly probable that the same speed can be obtained finally as when speed is insisted on from the start.

2. If during learning the attention is directed solely to accuracy, the speed will gradually improve. If attention is directed solely to speed, the accuracy tends to diminish.

3. Between the two methods employed—(*a*) exclusive attention to speed, and (*b*) exclusive attention to accuracy—there seems little to choose when considered simply as methods of learning. The choice must depend on other considerations, e.g., how soon it is desired to use the product.

4. Without special apparatus it seems unwise to demand speed from the *very* beginning, as it becomes more difficult for the learner to acquire 'correct' movements (assuming these to be ultimately valuable).

5. It seems probable that a high quality of work can be obtained finally, without insisting on a high quality constantly throughout the learning process. This would appear to have a very general bearing on methods of teaching.

9. *The Right Emphasis in Developing Skill*

G. C. Myers, "Speed versus Accuracy in the Development of Industrial Skill," *Journal of Personnel Research*, 4:20-21 (1925); reprinted by permission of Williams & Wilkins Co.

The teacher of industrial skills cannot afford to forget the fact that he is working to establish precise motor habits. He knows that in his school, if, by working for speed, the pupil learns an incorrect movement, this wrong coördination must be unlearned before the correct pattern can be established. Every mistake made in learning to manipulate a machine or to establish the bond 9 x 3, retards progress in those skills later on. A specific answer then, to the query, "Does early speed affect later accuracy?" is most pertinent to his problem.

There is scientific evidence for "Accuracy First." Some years ago an investigation by Margaret Broom, Augusta Spett and the writer, of the relation of speed and accuracy to learning, definitely demonstrated that if accuracy is stressed in early learning, not only will the performance be practically perfect at the end of the train-

ing period, but also the speed will be greater than under conditions of learning where speed is emphasized.

This experiment consisted of placing 36 colored cubes, that had been previously shuffled, according to a certain pattern. The subjects were all girls and were divided into two groups of eight. One group was instructed to work for speed, and were reminded by their leader at each trial to speed up all they could. The other group was told to emphasize accuracy. They were reminded at each trial to take great care that no errors were made. It was found that although the speed group placed the blocks in much less time during the first several days, they were at the same time developing a number of errors which tended to become more and more fixed and finally provided an effective block against further increase of speed. On the other hand, after about a score of trials, the accuracy group overtook the speed group. At the end of sixty days this group had increased its relative gain over the speed group. Not only was the performance of the accuracy group practically perfect, but it was *more rapid.*

A similar experiment in typewriting was performed by two squads of seven girls, each practicing three minutes a day for thirty-six consecutive days. In this case, at the end of the period the accuracy group had not gained much over the speed group; but later, after four months of no practice by any of the performers, when each squad copied, for speed, unfamiliar material for ten minutes, the speeders wrote an average of 383 words, while the accuracy group wrote an average of 451 words. The quality of the accuracy group, although not perfect, was an average of 1.2 words wrong per hundred words written; that of the speeders was 2.2.

It is interesting to note that in the latter part of the experiment the speed girls reported that they had difficulty in keeping from emphasizing accuracy while the accuracy girls tended to work for speed, even though they knew that they were placing their accuracy in jeopardy by so doing. If the groups had been able to maintain the initial attitude called for in the first part of the experiment, it is possible that the above results might be still more definitely in favor of the accuracy group.

10. *Effects of Correct Training*

E. FARMER and R. S. BROOKE, *Motion Study in Metal Polishing,* Report No. 15 of the Industrial Fatigue Research Board, 29-31 (His Majesty's Stationery Office, London, 1921)

The study of the methods of 26 different roughers made it clear that a very unsatisfactory state of affairs existed, and showed that

there was urgent need for a training scheme which would in the first place teach the roughers the best method of work, and in the second place would focus their attention on their work.

Since even the most experienced roughers had no idea of the number of strokes they made in roughing each portion of an article, this had first to be determined for them. Accordingly three experienced workers who roughed in a good easy style were studied on the following articles: Teaspoons, dessert spoons, tablespoons, dessert forks and table forks—all of the baguette or ridge pattern. An average was then taken of their strokes, and one or two added to the number on each portion to make the standard more accessible to the indifferent worker.

Instruction cards like that below were then printed and pinned upon the bench in front of each worker. . . .

INSTRUCTION CARD X

TABLE SHOWING NUMBER OF STROKES GENERALLY REQUIRED ON SPOONS

Suggested Order	Teaspoons	Dessert Spoons	Tablespoons
Edges of handles.............	36	36	42
Front of handles.............	8	10	12
Back handle	4	3	6
Back shank and one-half bowl.	10	12	18
Back of bowl................	8	10	13
Edges of bowl...............	10	10	11
Bowl mouth and front shank..	8	12	13
Shoulder and shank edges....	10	12	14

The above are the number of strokes generally required on the surfaces of each spoon, and on the edges of each six teaspoons, and of each four dessert, and each four tablespoons.

The whole of each surface should be covered by the above number of strokes, then look at the work, and unless you see a fault, further strokes are unnecessary.

READ DOWN EACH COLUMN, NOT ACROSS
REMEMBER SLOW HARD STROKES ARE BETTER THAN QUICK SOFT STROKES

These instruction cards were successful in that they interested the workers, although the more experienced roughers were skeptical about their utility; still, the mere fact that they began to count their strokes in an effort to prove that the number laid down was inadequate, resulted in their taking a more intelligent interest in

their work, and so in spite of themselves, they began to do away with many unnecessary strokes. The immediate improvement that resulted may be judged by the fact that the roughers' output during the week following the posting up of these cards improved by 13 per cent.

Any further interference was thought inexpedient with the really experienced roughers, but a week's course of training for as many as possible of the semi-experienced was decided upon. This course of training was under the immediate supervision of the investigator, while the best rougher in the shop was employed as demonstrator and technical adviser. . . .

The combination of a demonstrator and an instructor is very essential, for in the majority of cases, the foreman or forewoman rougher, however skilful he or she may be, have not the power of explaining their methods to others, while the beginner is incapable of learning by mere observation the best methods of work.

Twelve girls with some previous experience were passed through this training school. . . . The table below gives a comparison before and after training.

TABLE SHOWING AVERAGE CHARACTERISTICS OF TWELVE WORKERS ROUGHING THREE DOZEN BAGUETTE DESSERT SPOONS (BEFORE AND AFTER INSTRUCTION)

Time Taken (minutes)		Strokes Made		Weight Recorded (ounces)	
Before	After	Before	After	Before	After
126	89	119	83	1.85	1.75

11. *Measuring Progress in Learning*

G. BERLING, "Planmässiges Einführen des Menschen in der industriellen Arbeitslauf" (Systematic Instruction in Industrial Operations), *Industrielle Psychotechnik,* 3:79-86 (1926)

Instruction in the skillful manipulation of the hammer proceeds as follows: A model of an anvil is set up and the force of the blow delivered is transmitted at the other end of a lever to a weight scale. Drill in the proper graduation of the intensity of the blow can thus be given. Various substances have differing resistances to pounding and the adjustment of the intensity of the blow can readily be taught in this manner. The deviation of the obtained readings from the required standard values serves as a measure of proficiency, which when plotted on a curve and shown to the

apprentice at the end of each trial, informs him of the effects of his practice and thereby motivates further learning. Only when the initial fluctuations of the curve are succeeded by a uniform flattening can further practice be eliminated. . . .

Similar devices have been employed in teaching filing. A graphic record of the evenness of pressure is made from accurate micrometer readings. Systematic instruction of this sort has resulted in a reduction of learning time and more thorough training. The mastery impulses of the learner are strongly aroused by this method and greatly facilitate his progress.

12. *Accuracy in Hammering Measured*

R. BOLT, "Anlernverfahren für das Arbeiten mit kleinen Hammern" (Teaching the Use of Small Hammers), *Industrielle Psychotechnik*, 3:197, 203 (1926)

Accuracy in hammering may be inculcated by supplying the learner with a pointed hammer and a lead block. First, the learner simply dents the surface of the block with holes made by his pointed hammer. Then he tries to hit the same holes twice, which is difficult because of the small striking surface. Finally, he closes all the holes by striking the block with the flat side of the hammer-head, using as few strokes as possible.

With this preliminary trial the learner is brought before another lead block covered with prepared paper. The sheet contains 15 small squares, each with a central dot. The learner is asked to strike each dot twice; after he has made 30 strikes the paper record is examined, and the distances of the contact points from the central dots measured in mm. The averages of these distances is plotted for successive daily trials, and the resulting curve helps the learner in his progress. . . .

Accuracy in directing a larger hammer is taught by having a circular punch at one end of the hammer which strikes upon a paper bearing circles of approximately equal size. If the blow is true, concentric circles are formed, but errors produce irregular overlapping.

13. *Psychotechnics of the Typewriter*

J. M. LAHY, "French Psychologists Improve Typewriting," *Industrial Psychology*, 1:33-37 (1926)

The science of work has only been able to work in a small number of hand crafts. Until recent times typing has been founded

upon no other rules than those of individual discoveries due to chance.

In the keyboard the letters have been grouped according to their frequency within the regions one would suppose to be the easiest to reach.

In placing the letters solely according to their degree of frequency, they have neglected to determine the influence of *combinations of letters* on the rapidity of strokes. In this limited research they have not known what were the most used movements, or how to utilize in the strokes the most frequent combinations of letters. The keyboard called "universal" is far from being the best keyboard even for the Americans who invented it and gave it to the rest of the world.

As yet man has failed to determine the best rules for typewriting apprentices to follow. They have falsely compared the touch of the typist to that of the pianist, and this resulted in the ten-finger method with a usefulness more apparent than real.

An experimental study was made of the duration of letter strokes while typing and of the time intervals between the strokes. A record was obtained of the duration of the intervals which separate the successive letters struck with the fingers of the same hand, and compared with the duration of the intervals which separate the letters struck with the fingers of the hands alternately.

The mean of the alternate intervals is always much less than the mean of the non-alternate, the latter requiring thrice the time of the former. The inference to be drawn from this is clear.

14. *Effects of Praise versus Blame*

ELIZABETH B. HURLOCK, "An Evaluation of Certain Incentives Used in School Work," *Journal of Educational Psychology*, 16:157, 159 (1925); reprinted by permission of Warwick & York, Inc.

The data of this experiment point to the following conclusions:

1. The greatest amount of average improvement at the end of a series of tests, over and above practice, was found in the group that was praised for improvement in work, and was urged and encouraged to do better in the succeeding tests. Decidedly less improvement was found in the Reproved Group, less still in the Ignored, and none at all in the Control.

2. The results for the boys and girls within each group were compared, and they showed that in the case of the girls, the greatest improvement followed praise, and in the case of the boys, reproof. In both cases, however, praise was decidedly more effective than reproof. The boys who were ignored showed slightly more

improvement than did the girls, while in the Control Group, both boys and girls did worse, on the average, at the end of the series of tests than at the beginning.

3. Grade comparisons showed younger and older children to be about equal in responsiveness to the incentives of praise and reproof at the end of the series of tests. In the Control Group, the older children decreased their work slightly, showing that they needed some incentive, while the younger ones did about the same.

4. Praise proved to be decidedly the most effective incentive to use in the case of all children, when classed as "superior," "average," or "inferior" on the initial test. Within the groups, the "inferior" children were most responsive to praise, and the "superior" to reproof. Being ignored brought about only slight improvement on the part of "superior" and "inferior" children, and little more on "average." Practice without some form of incentive showed the "superior" children to do, on the average, worse work at the end of the series than at the beginning, the "inferior" to do about one-third better, and the average exactly the same.

5. Increased accuracy in performance was found only in the work of the children who were praised or reproved. The group that was praised, however, made greater improvement than the group that was reproved. The Ignored and Control Groups both showed a decrease in accuracy at the end of the series.

These results as a whole point conclusively to the fact that regardless of the factors of age, sex, initial ability, or accuracy, praise is decidedly the most effective of the three incentives here investigated. Reproof, when first used, seemed to be about equal in value to praise, but with continued use its effectiveness showed a decided decline. To ignore children in a group where the other members are receiving some incentive seems to be psychologically bad. The longer they are ignored, the less improvement do they show, even in spite of the opportunity to improve which comes from continued practice in one form of work. Hence, we may conclude that praise is the best form of incentive to use, no matter from what angle we may regard the matter.

15. *"Cold Storage" versus Application Theories*

C. R. Allen, *The Instructor, the Man and the Job*, 336-337 (J. B. Lippincott Co., 1919); reprinted by permission

Training for Deferred Values: "Cold Storage".—According to this theory all auxiliary knowledge, and all training in general, should be mastered by the learner before he has occasion to apply it in actual work. In instruction work organized on this basis a

learner is, for example, thoroughly drilled on decimal fractions before he needs to use the micrometer in the machine shop; or he is given board measure before he has occasion to use it in the carpenter shop; or he is informed how to figure resistances of various sizes of wire before he meets that kind of problem in his electrical practice; or he is "taught" how to figure an indicator card before he is allowed to "take" one in steam practice.

According to this theory the learner is first given the required knowledge and later, when the necessity arises, he is expected to be able to apply it, that is, just as eggs can be put in cold storage, kept until wanted and then used, so it is expected that a learner can master the method of doing a technical job, say a calculation, or a piece of auxiliary knowledge, or a safety first item, and can carry it in his head until it is needed. The principle on which work of this sort is based assumes that the application value of the work is *deferred* until some time after it is learned or acquired, hence it is called the principle of deferred values, or often the "cold storage" principle, because the learner carries it in a sort of mental "cold storage" until it is needed.

Training for Immediate Values: "Application".—According to the other principle all information, etc., should be given *at the time that it is needed on the job,* so that according to this principle, no "cold storage" period should come in between acquisition and application. This principle is known as the principle of instructing for immediate values, or the "Application Principle."

According to this principle a learner would not be given any one piece of auxiliary information or process until he needed it in his practical work. He would then learn the process by being taught on the job how to solve that particular problem. By this method a man would not be taught, for example, indexing or riveting, or laying off a certain pattern, until he was instructed in actually doing that job, or the job of which that operation was a part. He would then be taught how to make the necessary calculations or constructions, or operations at that moment, on the job, by being required to do that work before he could go ahead with the job.

16. *Using the Occupational Description for Training*

W. D. Scott, R. C. Clothier, and S. B. Mathewson, *Personnel Management*, rev. ed., 347-348 (McGraw-Hill, 1931)

The Occupational Description enables the employee himself to get a well-rounded idea of the nature, duties, and responsibilities of the position, its specific duties, the machines, tools and materials he will use and the special ability or skill he should possess. It

will also inform him concerning the amount and kind of education and experience he should have as well as the language ability—if any—required and the personal qualities needed. Such educational information is invaluable to the employee who is eager to make good on the job, for it enables him to map out a course of self-improvement for himself to strengthen himself in those elements in which he considers himself to be weakest. Furthermore, he will gain an exact knowledge of where success in this new job will lead him and he can prepare himself more intelligently for such promotion. It is obvious that such information in the hands of an alert employee will make him more receptive to the training opportunities afforded him in the company and at the same time will help him to help himself through self-education.

The use of the Occupational Description in helping build specific Training courses consists in assuring that the executives responsible for training shall be informed of the same essential facts. They will be able to carry forward the building of training courses for employees with maximum effectiveness in minimum time because the training will tend to become more and more definite and specific. The ineffectiveness that exists in some training efforts in recent years has arisen because of the lack of adequate information on the part of the instructor concerning the specific training requirements of the actual occupations in the company. General knowledge of duties and requirements secured through casual observation of the work is not enough. Recourse to the detailed information contained in the Occupational Descriptions must be had, and this must be supplemented when necessary by further analysis of the specific requirements of each position.

17. *The Components of a Typical Job*

W. W. CHARTERS and I. B. WHITLEY, *Analysis of Secretarial Duties and Traits*, 74-75 (Williams & Wilkins Co., for the National Junior Personnel Service, Inc., 1924)

Frequency Ranking of Duties.—In Table I is found the frequency ranking by 715 secretaries of 871 duties collected in interview. This table should be read as follows: *Typewriting letters,* duty number 33 (3) (this refers to the printed duty list which was sent out to be checked and means that on this list *typewriting letters* will be found in the third column of duty number 33), was checked 683 times out of a possible 715 times, and is therefore entitled to first rank. The next duty "answer telephone" was duty number 168, and was checked 682 times out of 715, which gives it a rank of 2, and so on through the entire list.

TABLE I

FREQUENCY RANKING OF 871 DUTIES

Rank	Number	Duty Number	Duty
1	683	33(3)	Typewriting letters
2	682	168	Answer telephone
3	668	33(1)	Dictation of letters
4	668	33(2)	Transcription of letters
5	665	166	Use of telephone—local
6	643	19	Address envelopes, packages, etc.
7	638	17	Insert letters in envelopes
8	630	16	Fold letters
9	618	441	Order supplies of various kinds in office
10	614	439	Place telephone memorandum where employer will see it
11	604	509	Write letters not dictated (compose letters)
12	602	169	Send telegrams
13	589	23	Seal mail
14	581	20	Sign mail (dictator's mail)
15	580	523	Clean and oil typewriter
16	567	22	Mark, attach, or get enclosures
17	566	161	Get material from files
18	565	18	Stamp letters, packages, etc.
19	561	35(4)	File letters
20	548	167	Use of telephone (long distance)

[The table continues in equal detail for 871 items.]

18. *Analysis of a Trade*

L. S. HAWKINS, "Training Tile-Setting Apprentices," *Journal of Educational Research*, 14:135-139 (1926)

By means of a series of interviews with a tile contractor who was also recognized as a thoroughly competent title-setter, a rough analysis of the trade was drawn up. No attempt was made to secure a detailed list of all of the minor operations in the trade. It early became apparent that nearly every job of tiling involved certain fundamental skills and that a large part of the tile work done consisted of plain floor and wall work. A careful analysis was therefore made of one job, namely "a typical bathroom job, floor and wainscoting."

A list was then made of the different jobs in the trade. Those involving identical or nearly identical skills or abilities were grouped together. As a result of this analysis and grouping, a list of some twenty-five groups of jobs was secured, and a typical job was then selected from each group. It was found that the great

bulk of the work of the tile-setter fell into eleven of these groups. The abilities needed to perform the jobs in these eleven groups were also required to perform the jobs in the remaining fourteen, but each of the fourteen groups required some abilities in addition to those needed for the first eleven groups. It was, therefore, tentatively decided to build the basic course around the eleven typical jobs representing the eleven groups, and to build the advanced course around the fourteen typical jobs representing the remaining fourteen groups. Five of the jobs around which the basic course was built were floor jobs; one was a base job; four were wall jobs; and one was a fireplace job. An analysis of the difficulty of these jobs placed them in the foregoing order.

In order to decrease the number of learning difficulties to be encountered in the first few jobs and to provide sufficient opportunity to acquire the fundamental skills, several additional floor jobs were introduced with only slight variations or modifications of the easiest floor job. This provided, as a total, a series of nineteen jobs for the basic course. These jobs were tentatively arranged in the order of the learning difficulties involved. Since this arrangement was quite different from the regular production order, it was not easy to convince the practical tile-setters and the representatives of the manufacturers who were conversant with the practical procedures that the order established by learning difficulties should be used. However, they took it on faith. The information on which the foregoing procedure was based was secured from the tile contractor before mentioned, one of his best tile-setters, and several representatives of the manufacturers who were familiar with setting as well as manufacturing. From the beginning a young man from the Associated Manufacturers' staff acted as reporter and secretary. Although he had considerable information concerning the tile industry he was entirely inexperienced in setting tile.

It was determined that the basic course should consist of two parts: (1) specific directions for the performance of the nineteen type jobs selected, with only as much technical information as would be necessary to enable the learner to perform these jobs understandingly and (2) a body of related technical information which would generalize the experience gained from performing these type jobs. Since the advanced course was to be used with those who had already gained experience in the trade, this course was made a combination of directions for performing the jobs and technical information relating to them.

The Basic Course: (1) Performance.—The first course consisted of detailed directions for performing nineteen typical jobs of tiling.

In the preparation of the text material of this part of the course, three men were used—an experienced tile-setter, his helper, and the reporter mentioned above. The tile-setter first described the job, and the reporter took down the procedure as described. Extended discussion and questioning expanded this description. The tile-setter or his helper then performed the job, and the reporter followed the procedure, carefully checking up his notes and stopping for correction wherever the written directions were at variance with the procedure of the tile-setter. In many instances, but not in all, the reporter then took his own manuscript and performed the job, following the directions he had written. Photographs were taken to illustrate the major operating points. At the close of each job the operations performed were listed in the order in which they appeared. This list of operations afforded the teacher checking points on each job. For each job the tools and materials used were enumerated and a set of questions for the learner was prepared.

When the directions for the first ten jobs were complete, a group of ten experienced contractors and setters called together from various parts of the United States carefully considered the manuscript as it was read aloud to them. Some corrections were made, and the procedure, as it finally stood, was approved as standard practice. The directions for the remaining nine jobs were produced in the same way and were submitted one at a time to the contractors and setters before mentioned. In some cases revised manuscripts were submitted.

The Basic Course: (2) Related Technical Information.—The technical information thought necessary to supplement the course consists of a series of seventeen lessons. The scope of these lessons was determined by an analysis of the text material of the basic course. The technical information relating to the specific jobs was classified, and lessons were outlined to include all phases of such information. The lessons were then written in such a way as to make general the application of the experience provided through the jobs. For example, in the basic course several kinds of mortar are used, and certain explanations and cautions are given in connection with their use. Accordingly, one of the related technical lessons is "Mortar-Setting Beds." This lesson deals with the various kinds of raw materials used in mortars, different effects obtained by combinations and why, conditions which influence the mixing and application of mortar—in short, the generalized theory and practices connected with making and using mortars. The information contained in these lessons was gathered from an extensive literature including a wide range of trade publications

and from consultation with a large number of contractors, setters, manufacturers, and supply men. In manuscript form these lessons were critically read by eight expert craftsmen. The lessons were then revised and submitted to these men again. The list of jobs and theoretical lessons are given in Table I.

TABLE I

Associated Tile Manufacturers' Basic Course in Tile-Setting and an Outline of the Related Technical Information

(The number of hours required for each job at Dunwoody is given in parentheses.)

Performance		Theory	
Number	Job	Number	Lesson
1.	Making the mortar-setting bed and placing 6″ x 3″ white vitreous tiles (7¾).	1.	Popularity of tile work.
2.	Beating in 6″ x 3″ white vitreous tiles (1¾).	2.	How vitreous tiles are made.
3.	Grouting and cleaning 6″ x 3″ white vitreous tiles (2).	3.	Beating in.
4.	Setting a plain floor, 6″ x 3″ white vitreous tiles, broken-joint style, spaced joints (5¾).	4.	Grout and grouting.
5.	Setting a plain floor, 6″ x 3″ white vitreous tiles, block-joint style, spaced joints (3½).	5.	Concrete-setting beds.
6.	Setting a plain floor, 6″ x 3″ white vitreous tiles, basket pattern, trowel joints (5).	6.	Mortar-setting beds for floors and other horizontal surfaces.
7.	Setting a plain 2″ hexagon floor (5¾).	7.	Cutting and drilling tiles.
8.	Setting a plain floor of ¾″ square ceramic mosaic, broken joint (7¼).	8.	The manufacture of tiles other than vitreous ones.
9.	Setting a ¾″ square ceramic mosaic, broken joint, field with a Grecian key border (6).	9.	Preparations of surfaces to receive foundations for tile work.
10.	Preparing for and setting 6″ x 6″ base and a plain floor of ¾″ square, broken joint, ceramic mosaic on wooden construction (23).	10.	Establishing levels.
11.	Preparing for and placing a concrete-setting bed on a counter-sunk wooden floor and setting 1″ hexagon tiles in relays (14).	11.	Scratch coats.
		12.	Mortar-setting beds for walls, other vertical surfaces, and ceilings.
		13.	Tile-trimmers.
		14.	The tile-setter's tools.
		15.	The care and protection of tiles.
		16.	The interpretation of working drawings.
		17.	The tile-setter's responsibilities.

Performance	
Number Job	
12. Preparing for and placing scratch coat on a brick wall and setting 6″ x 3″ glazed tile, broken joint, with 6″ x 2″ cap and 6″ x 6″ base (21¾).	
13. Setting 4¼″ x 4¼″ glazed tiles, block-joint style, and 4¼″ x 2⅞″ cap and 4¼″ x 4″ base, with string joints (29¾).	
14. Setting 4¼″ x 4¼″ glazed tiles, broken-joint style, with 4¼″ x 2⅞″ glazed cap with 4¼″ x 4″ base (15).	
15. Preparing a wooden partition and adjoining brick wall for tile work and setting 4¼″ x 4¼″ glazed tiles, cap, and base, straight or block-joint style, with an outside corner formed with quarter round combinations and a square inside corner (38½).	
16. Setting 6″ x 3″ glazed tiles, cap, and base, broken-joint style with inter-locking outside and inside corners formed with radius combinations (43¾).	
17. Setting 4¼″ x 4¼″ glazed tiles, cap, and base, block- or straight-joint style, with an outside corner and inside corner formed with quarter rounds (31).	
18. Sloping to drains and setting cove, inside corners and 1″ hexagon ceramic mosaic on a shower-bath floor (17¼).	
19. Preparing for and setting 6″ x 6″ dull glazed tiles on a fireplace (41).	

19. *The Laws of Learning in Industry*

H. E. Burtt, *Psychology and Industrial Efficiency*, 85-88 (Appleton, 1929)

The fundamental principles of learning that have been worked out in laboratory experiments with animals or in the schoolroom

apply equally to a worker in a factory or office learning a new job. The correct motions must be made repeatedly in order to form the proper connections in the nervous system. In most cases the emphasis should be on accuracy rather than speed, for the incorrect motion is actually a different one and will become associated with the work situation and be difficult to eradicate. If an incorrect method ceases to be employed it will gradually disappear through the principle of disuse. It is desirable to arrange it so that when the worker performs the operation correctly it will lead to some degree of satisfaction. This is just as important as the more usual dissatisfaction when he does it incorrectly. Reward and punishment in mild forms facilitate industrial learning. The principle of conditioned reactions may be utilized in teaching a worker to respond to some new signal by giving with it a signal to which he will naturally make the desired motion until this motion becomes associated with the new signal. While it is all right to show a person how to do the work the use of his own muscles is essential, and learning by doing is ultimately necessary. Attitude and incentive are important in learning and also in industrial work in general. The initial reception of the employee, the foreman under whom he takes up work and the surroundings, play quite a rôle in determining his attitude toward the work and toward the concern. Competition is often an effective motive, competition between individuals, between groups, or even with one's self. Rewards and prizes are occasionally effective. The wage incentive if properly handled and with no utterly unattainable goals is one of the most fundamental. Promotion is also a motivating factor in some cases. Minor considerations in the psychology of learning are partial activity—confining efforts to the crucial part of the situation rather than the whole machine—and analogy, in which previous experience with one industrial operation may facilitate learning another, provided, however, that there are some identical elements in the two situations.

It is sometimes illuminating to plot a practice curve to show one's improvement graphically. Such curves manifest many daily fluctuations due to numerous factors but the general trend is to rise rather abruptly and then level off, showing that initial progress is more rapid. Individuals differ considerably in the rate at which the curves rise. It is interesting speculation to try to determine the mathematical equation of the curve and thus predict ultimate level of efficiency on the basis of early performance. Plateaus or long periods of no progress followed by a subsequent rise often appear in practice curves. Some of these may be due to the getting of lower types of habits thoroughly automatized before

taking up higher types. Others may involve largely incentive and effort. A teacher knowing the critical stages may be able to eliminate the plateau. A study of industrial learning curves would very often be profitable.

Various special devices have been used to facilitate instruction of industrial workers. One of these is to take moving pictures of a skilled worker and present them slowly for the novice. The use of the stereoscopic principle to give the third dimension is desirable. The vestibule school is another device. Its special merit is that the learners are under skilled supervision and the person in charge can utilize some of the principles of learning above mentioned. . . . The desirability of systematic training in various kinds of industrial pursuit is shown in instances where record has been kept of workers learning the job with and without such training.

In training apprentices it has proven desirable to arrange progress according to the individual's proficiency rather than by the traditional method of consulting the calendar. Such schemes involve a job analysis followed by the development of some sort of manual or systematic course of instruction. To this end the trade may be divided into a number of sections and the apprentice works himself out of each by meeting certain standardized tests of proficiency in that section.

Foreman training courses are generally more profitable with the discussion rather than the lecture method. The content of such a course in addition to the usual matters of production, costs, and turnover might appropriately dwell on the human factor, the principles of learning and the importance of the foreman as an intermediary between the workers and the management.

Training salesmen in recent years is a quite different problem from what it was in the past. The trend now is toward institutional selling in which the man goes out and interprets the company's policies to the prospect. It is well to precede this with a job analysis of what the salesman really does. We may then teach him to give consideration to the prospect to whom he sells, the details of the product itself, and the sales policies of the concern. The final step is to initiate him in the actual selling job. As media for sales instruction we may note the possibilities of visual instruction (movies or playlets), educational agencies for some of the more general aspects, correspondence (with, however, some device to insure that the correspondence is read), and the sales convention which can be made more than merely inspirational.

C. Results of Training

20. *The Nature of Skill*

T. H. Pear, "Skill," *Journal of Personnel Research*, 5:480-482 (1927); reprinted by permission of Williams & Wilkins Co.

I would suggest the utility of reserving the word "skill" for the higher grades of performance. To say that a man can run does not necessarily imply that he possesses skill in running. But if he has learnt a good way to use his limbs, to regulate his breathing, to sprint at a particular point or moment, and if he has learnt all this with respect to different kinds of track, different lengths of race and different classes of competition, he may be said to possess skill in running races. This would also be true if he had acquired such ability in a blinder and less intellectual way, but that fact is irrelevant here.

The concept of skill which is proposed is that of *integration of well-adjusted performances,* rather than a tying together of mere habits. In man, at least, skill is acquired and fused with natural aptitude. . . .

Skill, as distinct from habit, involves the ability to be aware of and to correct faulty adjustment. A surgeon's or automobile driver's skill implies this. While it consists partly of habits, skill permits immediate interference with any single habit or combination of them. And this makes it difficult to study. Some disputes about skill in industry are unnecessarily acrimonious because these facts are not realized.

For example, by simplifying the processes in certain tasks a person may be trained in a few days (instead of, as formerly, a few months) to perform them. By the new method the task may be done as well as or better than by the old one.

But more may have been learnt—for good or ill—by the old method. The habits in the new task may be only a few of those in the old one. Moreover, they may be completely different habits. So the skilled worker is often aggrieved by the assumption that his work can be learned in a short time. And if his work be highly skilled in the sense in which we have used the term, he is justified.

21. *Effects upon the Worker*

L. M. Gilbreth, *The Psychology of Management*, 267-268 (The Macmillan Co., 1921)

The method laid down under Scientific Management is devised to further the forming of an accurate accumulation of concepts,

which results in a proper method of attack. The method of instruction under Scientific Management is devised to furnish two things:

1. A collection of knowledge relating in its entirety to the future work of the learner.

2. A definite procedure, that will enable the learner to apply the same process to acquiring knowledge of other subjects in the most economical and efficient way.

It teaches the learner to be observant of details, which is the surest method for further development of general truths and concepts.

The method of attack of the methods provided for in Scientific Management results, naturally, in a comparison of true data. This is the most efficient method of causing the learner to think for himself.

Processes differing but little, apparently, give vastly different results, and the trained habits of observation quickly analyze and determine wherein the one process is more efficient than the other.

This result is, of course, the one most desired for causing quick and intelligent learning.

The most valuable education is that which enables the learner to make correct judgments. The teaching under Scientific Management leads to the acquisition of such judgment, plus an all-around sense training, a training in habits of work, and a progressive development.

A partial topic list of the results may make more clear their importance.

1. Worker better trained for all work
2. Habits of correct thinking instilled
3. Preparedness provided for
4. Productive and repetitive powers increased
5. Sense powers increased
6. Habits of proper reaction established
7. "Guided original work" established
8. System of waste elimination provided
9. Method of attack taught
10. Brain fully developed
11. "Standard response" developed
12. Opportunities and demands for "thinking" provided
13. Self-reliance developed
14. Love of truth fostered
15. Moral sentiment developed
16. Resultant happiness of worker

QUESTIONS

1. Which should be more emphasized during the initial learning stages —accuracy or speed? Why? Can you suggest any reasons why the opposite view arose and is still commonly held?
2. Outline a sequence of steps which could be followed in giving a new workman an ideal introduction to his job.
3. Is it advantageous for a workman to plot a graph, recording the progress of his own learning? What is the reason for your reply?
4. List some mechanical devices that are used in industry to facilitate learning.
5. Criticize Gilbreth's statement of results obtained from training the worker under scientific management (page 271).

CHAPTER X

EFFICIENCY AND SCIENTIFIC MANAGEMENT

The movement known as scientific management is America's most distinctive contribution to industrial evolution. Fundamentally it is a crusade against waste in all forms, such as waste of time, energy, money, materials, thought, etc. Historically it originated as a means of speeding up the process of production within the plant, but it is not necessarily limited thereto. The spectacular results of scientific management in increasing output could be rivalled by equivalent changes in office management, marketing operations, and even household economy. Redesigning kitchens to save footsteps, adjusting sinks to the height of the user, etc., are samples of the extension of the principles of scientific management to fields remote from the thoughts of the founder.

Under the names of Taylorism, rationalization, and even Fordism, the movement has spread to the major manufacturing countries of Europe. Because of its unsavory past, Taylorism has often been viewed by spokesmen for the proletariat as the climax of oppressive capitalism. That this is a mere fortuitous association is apparent to any observer of the industrial growth of post-war Russia and Germany. Rationalization can function in the interests of a socialistic order as well as in the interests of stockholders.

A critical examination of scientific management will indicate both the merits and deficiencies in any proposed scheme for regulating human behavior. On the positive side we may place its remarkable simplification of work operations, its labor-saving devices, and the influence of its economizing spirit in the fields of activity. Negative features include its disregard or ignorance of the effects of these changes upon the worker's attitude, the one-sided subservience to managerial policy without reference to the repercussions of that policy upon community welfare, and the absence of statistically sound or scientifically valid techniques of rate-setting. It should be noted that all these

drawbacks are remediable, and that they no longer characterize the work of the more progressive Taylorites. In fact, these evils are not inherent features of scientific management at all, but simply abuses which have crept in from the outside. Chemical knowledge may be used to slay human beings or to alleviate age-old suffering.

There is no other division of industrial affairs in which the need for the psychological viewpoint is more vital. It might have proved the saving grace of the older efficiency engineers. Those among them who learned their psychology after rather than before they entered upon consulting practice realize this all too keenly.

A. Time and Motion Study: the Traditional Engineering Approach

1. *The Birth of Scientific Management*

F. W. Taylor, *Principles of Scientific Management*, 40-47 (Harper & Bros., 1913); reprinted by permission

The first illustration is that of handling pig iron, and this work is chosen because it is typical of perhaps the crudest and most elementary form of labor which is performed by man. This work is done by men with no other implements than their hands. The pig-iron handler stoops down, picks up a pig weighing about 92 pounds, walks for a few feet or yards and then drops it on to the ground or upon a pile. This work is so crude and elementary in its nature that the writer firmly believes that it would be possible to train an intelligent gorilla so as to become a more efficient pig-iron handler than any man can be. Yet it will be shown that the science of handling pig iron is so great and amounts to so much that it is impossible for the man who is best suited to this type of work to understand the principles of this science, or even to work in accordance with these principles without the aid of a man better educated than he is. And the further illustrations to be given will make it clear that in almost all of the mechanic arts the science which underlies each workman's act is so great and amounts to so much that the workman who is best suited actually to do the work is incapable (either through lack of education or through insufficient mental capacity) of understanding this science. This is announced as a general principle, the truth of which will become apparent as one illustration after another is given. After showing these four elements in the handling of pig iron, several illustrations

will be given of their application to different kinds of work in the field with the mechanic arts, at intervals in a rising scale, beginning with the simplest and ending with the more intricate forms of labor.

One of the first pieces of work undertaken by us, when the writer started to introduce scientific management into the Bethlehem Steel Company, was to handle pig iron on task work. The opening of the Spanish War found some 80,000 tons of pig iron placed in small piles in an open field adjoining the works. Prices for pig iron had been so low that it could not be sold at a profit, and it therefore had been stored. With the opening of the Spanish War the price of pig iron rose, and this large accumulation of iron was sold. This gave us a good opportunity to show the workmen, as well as the owners and managers of the works, on a fairly large scale the advantages of task work over the old-fashioned day-work and piece work, in doing a very elementary class of work.

The Bethlehem Steel Company had five blast furnaces, the product of which had been handled by a pig-iron gang for many years. This gang, at this time, consisted of about 75 men. They were good, average pig-iron handlers, were under an excellent foreman who himself had been a pig-iron handler, and the work was done, on the whole, about as fast and as cheaply as it was anywhere else at that time.

A railroad switch was run out into the field, right along the edge of the piles of pig iron. An inclined plank was placed against the side of a car, and each man picked up from his pile a pig of iron weighing about 92 pounds, walked up the inclined plank and dropped it on the end of the car.

We found that this gang were loading on the average about 12½ long tons per man per day. We were surprised to find, after studying the matter, that a first-class pig-iron handler ought to handle between 47 and 48 long tons per day, instead of 12½ tons. This task seemed to us so very large that we were obliged to go over our work several times before we were absolutely sure that we were right. Once we were sure, however, that 47 tons was a proper day's work for a first-class pig-iron handler, the task which faced us as managers under the modern scientific plan was clearly before us. It was our duty to see that the 80,000 tons of pig iron was loaded on to the cars at the rate of 47 tons per man per day, in place of 12½ tons, at which rate the work was then being done. And it was further our duty to see that this work was done without bringing on a strike among the men, without any quarrel with the men, and to see that the men were happier and better contented when loading at the new rate of 47 tons than they were when loading at the old rate of 12½ tons.

Our first step was the scientific selection of the workman. In dealing with workmen under this type of management, it is an inflexible rule to talk to and deal with only one man at a time, since each workman has his own special abilities and limitations, and since we are not dealing with men in masses, but are trying to develop each individual man to his highest state of efficiency and prosperity. Our first step was to find the proper workman to begin with. We therefore carefully watched and studied these 75 men for three or four days, at the end of which time we had picked out four men who appeared to be physically able to handle pig iron at the rate of 47 tons per day. A careful study was then made of each of these men. We looked up their history as far back as practicable and thorough inquiries were made as to the character, habits, and the ambition of each of them. Finally we selected one from among the four as the most likely man to start with. He was a little Pennsylvania Dutchman who had been observed to trot back home for a mile or so after his work in the evening about as fresh as he was when he came trotting down to work in the morning. We found that upon wages of $1.15 a day he had succeeded in buying a small plot of ground, and that he was engaged in putting up the walls of a little house for himself in the morning before starting to work and at night after leaving. He also had the reputation of being exceedingly "close," that is, of placing a very high value on a dollar. As one man who we talked to about him said, "A penny looks about the size of a cart-wheel to him." This man we will call Schmidt.

The task before us, then, narrowed itself down to getting Schmidt to handle 47 tons of pig iron per day and making him glad to do it. This was done as follows: Schmidt was called out from among the gang of pig-iron handlers and talked to somewhat in this way:

"Schmidt, are you a high-priced man?"

"Vell, I don't know vat you mean."

"Oh, yes, you do. What I want to know is whether you are a high-priced man or not."

"Vell, I don't know vat you mean."

"Oh, come now, you answer my questions. What I want to find out is whether you are a high-priced man or one of these cheap fellows here. What I want to find out is whether you want to earn $1.85 a day or whether you are satisfied with $1.15, just the same as all those cheap fellows are getting."

"Did I vant $1.85 a day? Vas dot a high-priced man? Vell, yes, I vas a high-priced man."

"Oh, you're aggravating me. Of course you want $1.85 a day

—every one wants it! You know perfectly well that that has very little to do with your being a high-priced man. For goodness' sake answer my questions, and don't waste any more of my time. Now come over here. You see that pile of pig iron?"

"Yes."

"You see that car?"

"Yes."

"Well, if you are a high-priced man, you will load that pig iron on that car to-morrow for $1.85. Now do wake up and answer my question. Tell me whether you are a high-priced man or not."

"Vell—did I got $1.85 for loading dot pig iron on dot car to-morrow?"

"Yes, of course you do, and you get $1.85 for loading a pile like that every day right through the year. That is what a high-priced man does, and you know it just as well as I do."

"Vell, dot's all right. I could load dot pig iron on the car to-morrow for $1.85, and I get it every day, don't I?"

"Certainly you do—certainly you do."

"Vell, den, I vas a high-priced man."

"Now, hold on, hold on. You know just as well as I do that a high-priced man has to do exactly as he's told from morning till night. You have seen this man here before, haven't you?"

"No, I never saw him."

"Well, if you are a high-priced man, you will do exactly as this man tells you to-morrow, from morning till night. When he tells you to pick up a pig and walk, you pick it up and you walk, and when he tells you to sit down and rest, you sit down. You do that right straight through the day. And what's more, no back talk. Now a high-priced man does just what he's told to do, and no back talk. Do you understand that? When this man tells you to walk, you walk; when he tells you to sit down, you sit down, and you don't talk back at him. Now you come on to work here to-morrow morning and I'll know before night whether you are really a high-priced man or not."

This seems to be rather rough talk. And indeed it would be if applied to an educated mechanic, or even an intelligent laborer. With a man of the mentally sluggish type of Schmidt it is appropriate and not unkind, since it is effective in fixing his attention on the high wages which he wants and away from what, if it were called to his attention, he probably would consider impossibly hard work.

What would Schmidt's answer be if he were talked to in a manner which is usual under the management of "initiative and incentive"? say, as follows:

"Now, Schmidt, you are a first-class pig-iron handler and know your business well. You have been handling at the rate of 12½ tons per day. I have given considerable study to handling pig iron, and feel sure that you could do a much larger day's work than you have been doing. Now don't you think that if you really tried you could handle 47 tons of pig iron per day, instead of 12½ tons?"

What do you think Schmidt's answer would be to this?

Schmidt started to work, and all day long, and at regular intervals, was told by the man who stood over him with a watch, "Now pick up a pig and walk. Now sit down and rest. Now walk—now rest," etc. He worked when he was told to work, and rested when he was told to rest, and at half-past five in the afternoon had his 47½ tons loaded on the car. And he practically never failed to work at this pace and do the task that was set him during the three years that the writer was at Bethlehem. And throughout this time he averaged a little more than $1.85 per day, whereas before he had never received over $1.15 per day, which was the ruling rate of wages at that time in Bethlehem. That is, he received 60 per cent higher wages than were paid to other men who were not working on task work. One man after another was picked out and trained to handle pig iron at the rate of 47½ tons per day until all of the pig iron was handled at this rate, and the men were receiving 60 per cent more wages than other workmen around them.

2. *The Methods of Scientific Management*

F. W. Taylor, *Principles of Scientific Management*, 117-118 (Harper & Bros., 1913); reprinted by permission

The general steps to be taken in developing a simple law of this class are as follows:

First. Find, say, 10 or 15 different men (preferably in as many separate establishments and different parts of the country) who are especially skilful in doing the particular work to be analyzed.

Second. Study the exact series of elementary operations or motions which each of these men uses in doing the work which is being investigated, as well as the implements each man uses.

Third. Study with a stop-watch the time required to make each of these elementary movements and then select the quickest way of doing each element of the work.

Fourth. Eliminate all false movements, slow movements, and useless movements.

Fifth. After doing away with all unnecessary movements, collect

into ones series the quickest and best movements as well as the best implements.

This one new method, involving that series of motions which can be made quickest and best, is then substituted in place of the ten or fifteen inferior series which were formerly in use. This best method becomes standard and remains standard, to be taught first to the teachers (or functional foreman) and by them to every workman in the establishment until it is superseded by a quicker and better series of movements. In this simple way one element after another of the science is developed.

3. *Instrumental Aids to Motion Study*

F. B. Gilbreth and L. M. Gilbreth, *Applied Motion Study*, 66-71 (The Macmillan Co., 1917); reprinted by permission

Having completed our microchronometer, we proceeded as follows: The microchronometer was placed in the photographic field near the operator and his working equipment, and against a cross-sectioned background or in a cross-sectioned field, and at a cross-sectioned work bench or table. The operator then performed the operation according to the prescribed method, while the motion-picture camera recorded the various stages of the operation and the position of the hand on the microcronometer simultaneously. Thus, on the motion picture film we obtain intermittent records of the paths, the lengths, the directions, and the speeds of the motions, or the times accompanying the motions, these records all being simultaneous; and the details of the conditions of the surroundings that are visible to the eye are recorded without the failings of memory. This was a distinct step in advance, but we realized that there was a lack in the records. It was difficult, even for one especially trained and experienced to visualize the exact path of a motion, and it was not possible to measure the length with precision from the observations of the motion picture film alone, as there is no summary or recapitulation of all the motions of a cycle or operation in any one picture. To overcome this lack we invented the cyclegraph method of recording motions. This consists of attaching a small electric light to the hand or other moving part of the person or machine under observation. The motion is recorded on an ordinary photographic film or plate. Upon observing our very first cyclegraph records, we found that we had attained our desire, and that the accurate path taken by the motion stood before us in two dimensions. By taking the photographic record stereoscopically, we were able to see this path in three dimensions, and to obtain what we have called the stereocyclegraph. This showed us

the path of the motion in all three dimensions; that is, length, breadth, and depth. It did not, however, contain the time element. This time element is of great importance not only for comparative or "relative" time, but also for exact times. This time element is obtained by putting an interrupter in the light circuit, that causes the light to flash at an even rate at a known number of times per second. This gives a line of time spots in the picture instead of a continuous cyclegraph light line. Counting the light spots tells the time consumed.

The next step was to show the direction of the motions. To do this it was necessary to find the right combination of volts and amperes for the light circuit and the thickness of filament for the lamp, to cause quick lighting and slow extinguishing of the lamp. This right combination makes the light spots pointed on their latest, or forward, ends. The points, thus, like the usual symbol of arrow heads, show the direction. The result was, then, of course, finally, stereochronocyclegraphs showing direction. These act not only as accurate records of the motions and times, but also serve as admirable teaching devices. Wire models of cyclegraphs and chronocyclegraphs of the paths and the times of motions are now constructed that have a practical educational value besides their importance as scientific records. These models are particularly useful as a step in teaching visualisation of paths by photographs alone, later. . . .

We have also devised and used many special kinds of apparatus; for example, devices for recording absolute continuity of motion paths and times, doing away with the slight gaps in the record that occur between one picture and the next on the cinematograph film, due to the interval of time when the film is moving, to get in place for the next exposure. To overcome this objection we have a double cinematograph, that one part may record while the other moves from one exposure to the next. In this way we get a continuous record of the operation. There have been occasional objections to all methods of making time and motion studies that involve the presence of an observer. Some of these have come from those working on what they consider their own secret processes, who object to having any observer record what they are doing, believing that the time study man is obtaining knowledge of their skill and giving them no information in return. Others have come from those who have seen or heard "secret time study" and "watch-book time study," and who regard all observers as spies because of general lack of understanding and co-operation; and there are some instances where they are right. For such cases we have designed an automicromotion study, which consists of an instanta-

neous modification of the standard micromotion apparatus, and also the autostereochronocyclegraph apparatus. This enables the operator to take accurate time study of himself. He can start the apparatus going and stop it from where he works, with one motion of his finger or foot. This invention supplies every possible requirement and feature for time and motion study processes, except the help and advice of a properly qualified observer, or the annoyance of having one not fitted by training, experience, or natural qualities to co-operate.

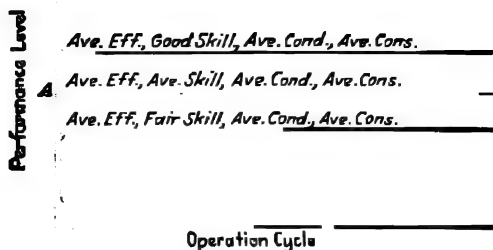
4. *The Leveling Method*

S. M. Lowry, H. B. Maynard and G. J. Stegemerten, *Time and Motion Study*, 118-120 (McGraw-Hill, 1927)

Suppose, for a moment, that it is possible to find an average man working on an operation which the time-study man wishes to study. This man will possess average skill and will work with an average effort. Assuming that conditions are average, the times for each element of the operation obtained from a study of this man will be the standard times which it is desired to determine. The study will be taken on a number of pieces, and while the time value determined for a given element will not be exactly the same for every piece because of minor differences impossible to detect, the average of these times, after abnormal values have been set aside, will give the standard time for that element which the operator may be expected to meet consistently. In other words, the average will determine the plane along which the operator possessing average skill will continuously work while giving an average effort. The standard-time values for all operations in the plant should be along this plane.

In most cases, however, it will not be possible to find an average man. Suppose, rather, that it is necessary to study a man who, although working with an average effort, possesses good skill. Because of this higher degree of skill, the average elemental time values determined from the study will be lower than those obtained from the average man. This second man will work along a higher plane than will the average man.

Similarly, if another man, working with an average effort but possessing only fair skill, be studied, the time values obtained will be higher than those of the average man, for this man will be working on a plane below the average. These levels are shown graphically in the figure below. The standard-time values as set from the time study should lie along the performance level AB, since this will allow the average man just to meet the established

time. In the last two cases considered, the level obtained does not coincide with the level AB because these two operators differed from the average operator in respect to skill.

COMPOSITION OF INDIVIDUAL PERFORMANCE LEVELS

Again, consider three operators all of whom possess average skill, but when working under average conditions, exert varying degrees of effort. If one man is an average man and hence is exerting an average effort, his average plane will be along AB. If the second man exerts a good effort, he will perform the operation faster than the first man will, and his performance level will be relatively higher. Lastly, the third man exerting only a fair effort will be working along a plane lower than AB.

Varying conditions will also affect the performance level. If two men are working under different conditions, even though they both have the same skill and give the same effort, the one working under the more unfavorable conditions will perform along a lower plane than the other.

It has been said that minor variations impossible of detection will cause the elapsed time for a given element to vary slightly when it is done a number of times. If this is slight, and the average time value does not differ greatly from the two extremes, the variation may be attributed to the inability of a human being to work with exact clock-like regularity, and the fact that the stop watch is read to only the nearest one-hundreth division of the dial. Where the variation is greater, there is undoubtedly something which, although impossible of detection, materially influences the performance of the work. Usually it is a deviation by the operator from this exact plane of work. This deviation is so small that it does not justify considering that skill, effort, or conditions have changed. These, while ranging from a minimum to maximum in a series of minute steps, are practically divided into only a few steps. Thus a slight deviation would not be great enough to change the

degree of skill, effort, or conditions from one class to another. At the same time, the readings show that there has been a change, and hence the average time value will be affected. This variation is called the consistency with which the operator works. The greater the consistency, the more nearly right will be the average value for the particular plane in which the operator performs. Thus it is seen that consistency must also be considered during the leveling process.

These four variables—skill, effort, conditions, and consistency—all influence the level at which the operator works. The first three are determined during the actual making of the time study. The last is determined after the subtractions have been made. These four together determine definitely along what performance plane any operator works at any time. When this plane has been located, it is a simple mathematical process to bring the time values determined from any study down or up to the desired standard-time values.

5. *Management through Planned Work*

HENRY FORD and SAMUEL CROWTHER, *Today and Tomorrow,* 99-101 (Doubleday, Page, 1926)

It is the work, not the man, that manages. That work is planned on the drawing board and the operations subdivided so that each man and each machine do only one thing. This is a general rule, but it is flexible and has to be applied with common sense. If a machine can be devised to perform several operations at once, then it would be waste to have several machines. A man may sometimes as easily perform two operations as one—in which case he performs two operations.

It is often imagined that our system of production is founded on moving platforms and conveyors. We use moving platforms and conveyors only when they aid in the work. For instance, in making headlights we do not use conveyors, because the nature of the parts is such that they can more easily be moved on in boxes than by a conveyor. On the other hand, in many departments we find conveyors extremely useful, and especially so in assemblies—that is, bringing the component parts of a unit together—for then the assembly can start at one end of the moving platform or belt conveyor and have its various parts added as it moves along.

The thing is to keep everything in motion and take the work to the man and not the man to the work. That is the real principle of our production, and conveyors are only one of many means to an end.

The key of our production is inspection. More than 3 per cent of our entire force are inspectors. This simplifies management. Every part in every stage of its production is inspected.

If a machine breaks down, a repair squad will be on hand in a few minutes. The men do not leave their work to get tools—new tools are brought to them, but they do not often need new tools, and machines do not often break down, for there is continuous cleaning and repair work on every bit of machinery in the place. When new tools are needed, there is no delay. Tool rooms are provided for every department. Once we had large supply rooms, and men lined up at the windows to get their tools. That was waste. We found it often cost us twenty-five cents' worth of a man's time (not counting overhead) to get a thirty cent tool. With that, we abolished the central tool room—a man cannot be paid high wages for standing around waiting for tools. Nor, which amounts to the same thing, can the public be served.

Stooping to the floor to pick up a tool or a part is not productive labour—therefore, all material is delivered waist high.

Our system of management is not a system at all; it consists of planning the methods of doing the work as well as the work. All that we ask of the men is that they do the work which is set before them. This work is never more than a man can do without undue fatigue in eight hours. He is well paid—and he works. When management becomes a "problem," the fault will be found to be with the planning of the work.

6. *A Cure for Soldiering*

F. B. Gilbreth, *Motion Study*, 291 (Van Nostrand, 1911)

Under old forms of management workmen "should keep busy at something," even if prevented from doing their regular work. An idle workman was considered a disgrace. The consequence of this was that the workman took his rest while working, or made believe work while resting. The old-fashioned kind of rest is called "systematic soldiering." It is the curse of the military type of management. It is a form of cheating that has been made respectable by the conditions forced upon the workers by the employers.

Under scientific management the evils of soldiering are eliminated, and the correct definite percentage of rest required is recognized and provided for. When a man is prevented by causes beyond his control from doing his regularly assigned work, he is told to use the opportunity for rest,—not to take such rest as can be obtained by making slow and useless motions, that will give him

an industrious appearance to the casual observer, but to rest, the 100-per-cent kind of rest.

7. *Wasted Time versus Good-Will*

A. B. Angles, "Unproductive Working Time," *Industrial Psychology*, edited by C. S. Myers, 112-114 (Thornton Butterworth, Ltd., London, 1929); reprinted in U. S. by permission of Henry Holt & Co.

If the economic loss arising from unproductive time in the factory is well marked, not less important are its adverse psychological effects. The phrase "Production rests on good-will" sounds like a platitude in these days of popular preaching, but it happens to be true, and is nowhere truer than in the present instance. So long as men are men and not machines, their productivity will be influenced by the working conditions which affect their good-will.

For example, it becomes particularly irritating to a keen pieceworker when he is kept waiting for the raw materials of his job. Naturally he likes to feel that the way is all clear for "full steam ahead." If this desire is balked, then he is gradually changed from a good workman to a grumbler, and as he in turn affects others the "morale" of the whole shop is ultimately lowered. If no permanent remedy for this complaint is soon found, a more or less unconscious slowing down of the work and a deterioration of its quality are almost inevitable. In any event a decrease in skill and a dislocation of natural rhythm arise from the repeated interruptions to continuous work.

The lack of a sufficient number of tools also acts as an irritant; and the firm's fancied economy in such a matter is not only expensive of time in the long run but also encourages the workers' disrespect towards the firm. The general effect of any or a combination of such factors as these is not a sudden revolt, but rather a gradual lowering of the "tone" of the workshop. "Keenness" is ousted by "slackness," and such general dissatisfaction arises that the unproductive times become lengthened and the productive periods are less productive than of old.

8. *Criticism of Taylor's and Gilbreth's Methods*

E. Farmer, *Time and Motion Study*, Report No. 14 of Industrial Fatigue Research Board, 13-16, 18, 24-25, 30-32 (His Majesty's Stationery Office, London, 1923)

Both Taylor and Gilbreth set before themselves the definite task of standardizing the human element in industry. They wanted to

make industry more efficient by reducing the cost of production. Some people when they attempt to reduce the cost of production think primarily of lowering the wages paid to labour, but Gilbreth and Taylor made no such mistake. They both realised that to reduce the cost of production by such a method is, in ordinary circumstances, short-sighted and fails in its real object.

They approached the subject from a more scientific standpoint, and attempted not to reduce the wages of labour but to increase them, provided that such an increase is accompanied by an increase in output. They did not leave it at this, but by their methods of time and motion study they sought to ascertain how and in what degree real improvement was possible.

The method adopted by them was one that paid considerable attention to the welfare of the worker. Taylor was careful to see that sufficient rest was introduced into the day's work, and Gilbreth has gone further and paid attention to such things as comfortable seating and bench accommodation. In spite of these considerations it is nevertheless true that their systems have caused a good deal of opposition on the part of labour, a fact that gave Taylor great concern. Hoxie in his report on Scientific Management and Labour and also the Committee appointed by the House of Representatives in its report, show clearly that in factories working under the Taylor system there is evidence that the workers think they are required to work at a speed which, in the long run, is detrimental to their health. It is significant that the evidence taken from workers by the Committee appointed by the House of Representatives, is to the effect that no real objection is felt to those parts of the Taylor system which deal with systemization and standardization, but that strong objection is felt to the methods of stimulation.

This objection to methods of stimulation seems to go to the root of the whole matter, both from the workers' point of view and also from the point of view of those whose approach to the question is one purely of scientific interest.

Whenever a new way of doing work was instituted by either Taylor or Gilbreth a new method of payment accompanied it. The details of the various methods of payment under the Taylor system need not here concern us. The general principle followed is that the actual piece rate should be lowered, but that the task should be so arranged that if the worker comes up to the standard required of him his actual weekly or daily earnings shall be higher than on the old system. The workers believe that under such a system they are induced to work at a speed which is deleterious to their health. It may be possible to continue working at such a speed

for several years, but they feel that it takes more out of them than they have a right to give if they are to have regard to their real efficiency as members of society, and not merely as workers in a particular factory. If such a system tends to use up their nervous energy at too great a pace, so that their decline in efficiency begins at an earlier period than would be the case if they worked under a different system, it can be to no one's advantage, except to that of their employer during their most energetic period, that they should work at such a speed.

The issue is confused for those who approach the subject of time and motion study from a theoretical point of view. They are desirous of discovering whether the principles on which the study is founded can be applied to the general problems of industry.

They realise that there is a physiological and psychological background to the whole of human effort, and they want to discover if the methods adopted in time and motion study really go to the root of the matter and indicate more economical ways of utilising human effort. Great improvements in efficiency have been effected by the introduction of new ways of performing certain industrial operations, but whenever these improvements have taken place, there have been two changes, one in method, and one in the system of remuneration, and we are at least entitled to enquire which is the predominating factor. . . .

From Gilbreth's point of view the quickest movement is the best, and so long as speed is the object to be attained this must necessarily be so. It does not, however, follow that the quickest movement is the easiest and the best for the worker to accustom himself to. It may make too great a strain on the nervous system to be advantageously employed by all workers. As has already been pointed out these quick movements are selected from various workers; possibly they may in some way be closely connected with the physical and mental make-up of the worker in question, and their transplantation as isolated motions into the movement system of other workers may be unwise. . . .

With regard to the standardizing of motions, it is doubtful if a set of movements, however good they may be, can necessarily be regarded as the best movements for every person concerned. Personal differences must be allowed for and the possibility admitted of the worker discovering a method better suited to his requirements than the prescribed one. In the majority of cases the standard method may prove the best, but in no case should it be forced upon a worker. Every worker should be taught the standard method and then allowed to follow his own devices, provided the results are satisfactory. . . .

If speed is the object sought, the value of any movement must be judged by its speed. There may, however, be another standard by which movements can be judged, namely that of the ease with which the worker can perform the movement in question. Those who take this view will dismiss the speed factor entirely from their minds. They will endeavour only to devise some method of doing the task in question, which shall be more in accord with physiological and psychological laws, and that will utilise the natural aptitudes of the worker in a more efficient way. Those working on this principle will not seek to discover how quickly a worker can perform a task, but will endeavour to arrange that the task may be done in such a way as to interfere in the least possible degree with the worker's rhythm. The effort of the worker will become the centre of attention and not the task.

There is no doubt in the writer's mind that this latter method of carrying on motion study is likely to yield more beneficial results than the former. It is undoubtedly more difficult, but it has the advantage of resting on principles which are of general application. So long as those interested in motion study are content merely to improve specific industrial operations no very important principles governing the general problems of the human factor in industry are likely to be evolved, but when the attention is directed to the more fundamental aspects of the problem, specific instances of improvement merely act as examples of the manifestation of a principle that can be applied to other industrial processes falling within a certain sphere of human activity. . . .

Mental associations will be formed for any set of movements that has become habitual to the worker, but if, when the terminal phase of one movement suggests the initial phase of the next to the mind, the hand should be in a position not well adapted to carry out the movement, irritation will be caused. The worker knows what is wanted, but attention has to be taken off the main object for a moment in order to direct the movement of the hand in the right direction. In a well thought out system of movements this should not be the case. The mental associations and the tendon and joint associations should run along parallel lines, and one should never be broken by the other.

In playing golf there are certain mental associations formed as to the right stroke to play on each occasion, but, paying attention to these, will almost invariably cause a bad stroke to be played. Through careful teaching and practice certain muscle and joint associations—generally called muscle memories—have been formed, and to these the player must pay attention if he is to play the proper stroke. So also in industry the mind should concern itself

solely with the object to be obtained, and wield only a general directing influence over the actual movements involved. The movements themselves should follow one another in a natural sequence. If the movements have been carefully thought out according to the plan suggested, they will follow in a rhythmic order that causes the least possible strain to the body and the least possible interference with the mind. When one process in the task is finished it will naturally suggest the one that is to follow, and then the hand should find itself in the best possible position for doing the work required, without any volitional change of direction. Every effort must be made to save the worker as much cognitive and volitional effort as possible, and attention should not be confined merely to saving physical effort. . . .

When time study is used solely for determining the time a task should take, it seems very unlikely that it will yield satisfactory results. In the first place, if the worker knows that he is being timed in order to set a standard time he will naturally tend to slacken his pace, so that too great a task may not be required of him later on. Taylor got over, or thought he got over, this difficulty by selecting a special worker and stimulating him to increased effort by increased remuneration. Gilbreth employs the same method. The result is that the time of the best worker is obtained when he is working under abnormal conditions, which increases his speed. Even if a deduction is made from this time for the average worker, injustice may possibly be done to the slower workers.

Generally, in any department there is one, or sometimes two or three workers whose output is far in advance of the average of the good workers in the department. In some cases this advance may amount to over 100 per cent. If this worker then is timed and a deduction of, say, 33 per cent made from the time, it still leaves the task of the others 66 per cent harder than it should be. If it is still further reduced so as to fall into line with the average worker, there is no point in having taken the timings in the first instance. If time study is to be used in this way it can only be used in order to speed up those who do not reach the standard of the best workers in a department.

If all workers were equal psychologically and physiologically, it might be assumed that if certain of them continually failed to come up to standard, it was due to laziness or some other moral fault. But there is no reason for thinking that all workers are equal. In fact there is every reason for thinking that they are not. Before any such use of time study as that made by Taylor and Gilbreth can be adopted, further progress must be made in vocational selec-

tion. If it were found possible to group people together in such a way as to do away as far as possible with the inequalities which, at present, exist between worker and worker, it might then be found possible scientifically to apply time study for the fixing of standard times and standard rates of pay. At present, however, we are very far from such a state and nothing but harm can come from any attempt to standardize work by means of a stop watch. . . .

There seems, therefore, very little necessity for all the elaborate apparatus that Gilbreth employs to determine the time and direction of movements. They are necessary for his system for reasons already explained, but they are not necessary for a system founded upon the assumption that those motions are the best which are most in accord with the psychological and physiological make-up of the individual. Cyclegraphs are certainly useful for determining the path followed by the hand or foot, but the time element in them is of no great importance. For instance, a set of motions might be devised which actually took longer to perform than the set to be superseded but which gave less fatigue to the worker, and so enabled him to perform them more often and more regularly. Such points as these, however, cannot be ascertained by the timing methods devised by Gilbreth. The idea of time should be dismissed from the experimenter's mind, except for the purposes already mentioned, and he should concentrate on getting an even and graceful movement that will do the work effectively. The fast stroke does not always win a rowing race; far more often the slow stroke is more effective, and, generally, such a system is more effective because it is slow and allows for plenty of time to recuperate between each effort. So it must also be in industry. No movement can be compared with another and said to be better than it merely on account of its speed, it should only be compared in respect to ease and final results.

B. Enhancing Productivity: the Psychotechnologist's Approach

9. *Definition of Efficiency*

A. T. Poffenberger, *Applied Psychology*, 349-352 (Appleton, 1927)

The fundamental purpose underlying industrial psychology, as well as industrial engineering generally, is the increase in efficiency of all operations. For many years industrial problems were attacked from the strictly engineering point of view where the concept of efficiency was relatively simple and the factors known. In such terms an efficient process is one in which the available results

exceed the expenditure. The degree of efficiency of a process is the ratio of available result of the process to the expenditure, and the most efficient process is the one that brings the maximum return for the least expenditure of energy. In a mechanical operation the available result is measurable in terms of units of the commodity turned out and the expenditure is measurable in terms of mechanical power applied, oil consumed to reduce friction, wear and tear, general depreciation, overhead, etc. The human operator is figured in the equation in terms of amount of his wages to be charged to expenditure.

Along with scientific management there entered into industry the belief that the human element is the costliest element on the expenditure side of the equation, and attention was directed to decreasing costs by increasing the efficiency of the human machine. Such a shift of emphasis implies the complete reorganization of industry, in equipment as well as in point of view. Instead of the individual being fitted into a routine of work, the routine must be modified to conform to the needs of the individual. In the course of this transformation, which has been taking place gradually and is by no means complete, there has been a tendency to carry over the mechanical definition of efficiency to the interpretation of human behavior. Although, in general outline, the definition is the same in both cases, the individual items to be included in output and expenditure are not identical. Neglect of one or more items, either of output or expenditure, will upset the equation.

On the side of output, results can be computed in terms of units of work done, much as in the case of a purely mechanical operation. In computing expenditure, however, serious difficulties are encountered. In the case of a machine the general depreciation or wear and tear to be charged per unit of output can be readily computed by knowing the lifetime of the machine and its cost. In the case of the human individual no one has had the temerity to make such calculations in terms of dollars and cents. Yet the human wear and tear differs considerably with the occupation, if work hazards in terms of sickness, accident and death rate, and if cost of insurance are accepted as indications. Some account of differences in hazard is obviously taken in the adjustment of wages to working conditions, but what an equable differential rate should be no one knows. To fail to take account of this factor in computing the cost of work is an error which may manifest itself in dissatisfaction in industry.

Serious obstacles are met in the calculation of human energy expended in doing a given piece of work. Neither in the psychological nor the physiological laboratory have practical means of

measuring energy expenditure been devised. It has been customary, in laboratory studies of the efficiency of work, to attempt to keep this energy factor constant by instructing the worker always to "do his best" and to measure efficiency directly in terms of output. The assumption, of course, is that "doing one's best" is a constant, and that the same amount of energy will always be expended in doing it. But numerous recent studies have shown that such an assumption is false, that "doing one's best" is a variable and the energy expended in doing it depends upon the nature of the task, upon the surrounding conditions, how long the work has been in progress, the satisfaction derived, etc.

There is one factor in human efficiency which does not appear at all in the definition of mechanical efficiency. Whatever the nature of one's philosophy of life may be, it would seem that a certain minimum of satisfaction is legitimately due to the worker as a part of the product of his work. This is an item of output quite independent of that satisfaction which is sometimes provided for by management as a means of stimulating output. Occupations differ considerably in the amount of this pure satisfaction that they give. It would be profitable to see the relationship between the degree of hazard of a series of jobs and the degree of satisfaction that they give, although this would be only one of the possible factors.

In spite of the difficulties to be met in measuring human efficiency at least a tentative definition of it will serve as a guide for the study of problems in industrial psychology. *The ideal of human efficiency would be the production of the maximum output of the highest quality in the shortest time, with the least expenditure of energy and with the maximum satisfaction.* Emphasis upon different aspects of this definition will lead to varying results. Management has emphasized increase in quantity and quality of output, labor has emphasized decrease in expenditure of energy. No one has, consciously at least, attached to satisfaction from work the importance that it deserves in the conception of efficiency. It will be evident that these three phases of efficiency are not unrelated. Conditions influencing one phase will affect the others also.

10. *Motion Study and the Adjustment of Material Conditions to the Worker*

H. D. Harrison, *Industrial Psychology and the Production of Wealth,* 108-112 (Dodd, Mead, 1925)

The general principles followed by the Industrial Psychologists in their investigations of the best methods of applying human energy in different factories seem to be these:

1. The consent, and if possible, the full coöperation of the workers is obtained before any investigation is begun and any changes are made.

2. No new method of payment or other factor likely to encourage the workers to increase their efforts must be introduced at the same time as a new method of work.

3. The effect of the change should be judged, not by increase of output, but by decrease in the fatigue of the workers in producing an equal or greater number of units of work. If fatigue is reduced the output will in time be increased, but if the increase in output is made the object of the change, "what purports to be a scientific investigation degenerates into a process of speeding up." Fatigue can be judged by the shape of the work curve and to some extent by the subjective feelings of the workers. If output is increased without any encouragement being given to the workers to increase their efforts in any way, it may be assumed that the increase is produced without added fatigue.

4. The series of motions involved in the operation should be studied as a whole, then each elementary motion should be observed and timed. If great differences are found—as is often the case—between the times taken in doing the same element by different workers, special care must be devoted to finding the cause of the difference and making any improvements which will make the series as a whole more efficient—that is, either more productive or less fatiguing or both.

5. In devising new methods it must not be assumed that a shorter series of movements is necessarily preferable to a longer series. It has been found that "a longer, continuous sweeping movement may prove far less tiring than a series of shorter angular ones, and a slower rhythmical rate may of course be more effective in the end than a faster one.

6. Keeping in mind this question of rhythm, we may still find it possible to eliminate false and unnecessary movements without prejudicially affecting the remaining movements as regards time or difficulty, and so substitute fewer, more efficient, more rapid or less fatiguing movements for comparatively inefficient ones.

7. One point to notice in this respect is that one of the most fatiguing processes of the mind is that of discrimination which involves close and conscious attention. Therefore, wherever possible, avoid this process by making rhythm the basis of the operation. A rhythmical process is one "which tends to repeat itself without conscious and deliberate effort, because it carries with it a certain affective tone of a pleasant kind, and is not hindered by

having to overcome checks." The phenomenon of rhythm will be fully discussed later on in this chapter.

8. Again, it has been shown that there is less effort needed to lift both hands together than to raise them one after another. If it is possible, therefore, it is advantageous to combine similar movements of the two hands.

9. Many motions are only made necessary by the relative positions of tools and materials, and can be eliminated by the better arrangement of these accessories, or by the provision of simple apparatus which allows better adjustment of the material conditions to the needs of the worker. I am forcibly reminded of Gilbreth's famous illustration of this point, with regard to bricklaying, by the fact that a foreman bricklayer at work on a bungalow, just in front of my window as I write, is engaged in laying bricks on a wall which is now some six feet high. His bricks are in a loose heap at his feet and his mortar board is on the ground near. Every time he needs a brick or some mortar he lowers his body, then raises it loaded through several feet, the nine-pound brick he raises through some six feet to the top of the wall. By introducing an adjustable scaffold, a table to take the mortar box, which was found to be better than a board, and the bricks so arranged that they could be taken up exactly in position for laying; and by a reduction in the other movements involved, Gilbreth increases the number of bricks, which a man could lay apparently without increased fatigue, from 120 to 350 an hour. (Much waste of human effort is occasioned by faulty routing, inadequate space, the irregular supply of materials, unsuitable work places, benches, tables, etc., and tools of the wrong size and weight.) Where these conditions are outside the worker's control they are also, if badly arranged, a source of constant though unknown irritation to the workers—a psychological state which has been shown to have a deleterious effect on both the quantity and the quality of the output.

10. It must be remembered throughout, that owing to the great differences in physical build and strength, age, habits, psychological qualities, and character, which exist between individuals, it is highly improbable that any one method, however good, will be the best for all persons. Therefore, there must be no attempt to force everyone into a common mould, as it were—the worker should be free to affect any method which he finds to be as effective as the "standard."

11. *Practical Methods for Movement Study*

G. H. Miles and A. B. B. Eyre, "Ease and Speed of Work," *Industrial Psychology*, edited by C. S. Myers, 94-100 (Thornton Butterworth, Ltd., London, 1929); reprinted in U. S. by permission of Henry Holt & Co.

In carrying out movement study, the following main points should be observed:

(1) *Frequency of Operations.*—It is well first of all to note which are those movements, whether of hands, arms, feet or of the body generally, which are most often repeated in the course of the work. Do not waste time at the start on those operations or processes which are carried out only perhaps a few dozen times a day, when there are others which are repeated many hundreds of times daily. It may be that those that are performed less often are obviously the most fatiguing in themselves; but the lighter operation, repeated ten times to the other's once, is in all probability the most fatiguing in the long run.

(2) *Length of Reach.*—One of the most obvious means of saving time and effort is whenever possible to reduce the distance which a worker has to reach for the articles he is handling. Apart from its effect on the worker's comfort, such reduction is frequently a means of increasing output; yet it seldom receives the attention it deserves.

In assembling, packing, repairing and construction work of all kinds, the worker must reach out his hand for material and tools hundreds, and very often thousands, of times a day. If these can be brought nearer to him by a rearrangement of the articles themselves, by the use of crescent-shaped in place of straight shelves, by altering the height of the bench, or by raising the back part of it, a great deal may be done to relieve strain and to save time. The further the reach, the greater in proportion is the strain on the muscles and the amount of body movement involved. It is during the latter hours of the day that these little extra efforts repeated many times over begin to have their effect.

Appearances are often very deceptive. The man does not *appear* to be in trouble, he has only to take a step or two to get at everything he wants. He is a good worker; he does not complain; his output is fairly satisfactory. Why worry? The man himself probably never suspects that he is at work under any difficulties; he has become accustomed to his conditions, having arranged matters according to his likes, as far as lay in his power, when he first took over the job. But it is one of the first duties of the industrial psychologist to put himself in the other fellow's place; to see what

the man needs, to ascertain where he is wasting his efforts, even when he himself does not realize this need or waste.

These remarks apply equally to the apparently small matters and to the more obviously important ones. It is the greatest mistake to regard anything as too small to be "studied." A tool-rack placed a foot beyond a man's reach is obviously in the wrong place. Even when it is reasonably near to him, he may have to stretch an inch further than is really necessary in order to reach it. It is not the foot but the inch that requires thought. In this case an inch is *not* the twelfth of a foot; it is very much more than that, for that inch comes *at the end of the man's reach.* It may make all the difference in the use to which the rack is put. In innumerable cases where there has been no consideration of the matter, the slight extra effort has perforce to be repeated hundreds of times daily. The effect on the man is cumulative, and adds to the total fatigue towards the end of the day.

(3) *Arrangement of Material.*—The time lost in looking for articles is a serious matter to the worker; economists will make it clear how he stands to lose in every way as regards waste of time. And yet when the matter is looked into more closely, it will be seen that the time element is the least important factor. If a worker is interrupted, say, twice a day for ten minutes by having to search for some tool, or whatever it may be, he loses both time and temper, and is a sadder man in consequence. And if those twenty minutes lost out of his working day are the sum-total of many little delays of seconds only, the results so far as he is concerned will be far more serious. His smooth working, his "rhythm," is being constantly interrupted; and each time this happens his efficiency is to a slight extent impaired. He is thus left unduly tired at the end of the day, whereas the same amount of effort put into smooth work would have resulted in more output at a cost of less fatigue. There is all the difference in the world between the healthy tiredness that comes from work and that other unhealthy kind which results from irritation and annoyance. . . .

(4) *Bi-manual Work.*—If both hands are used simultaneously in performing identical operations, the work is done with a saving of about 30 per cent of effort, by the coördination of muscles acting in conjunction from both sides of the body. This fact should be taken advantage of whenever possible. It is not to be applied only in lifting or carrying heavy weights; in repetitive work, whenever both hands and arms can be conveniently employed for the same action, the saving in effort and time will be valuable.

(5) *Speed, Direction and Rhythm of Movement.*—In general an easy change of direction and velocity is far better than direct,

straight-line movements. Thus if an operation requires that a worker's hand moves in succession to the three points of a triangle, a longer curved movement which takes in all these points is easier and far less fatiguing than a direct rectilinear path from point to point.

12. *Principles of Effective Motion*

C. S. MYERS, *Industrial Psychology*, 86-88 (Peoples' Institute Publishing Co., 1925)

From observations on movement study, three classes of movement of the worker have been distinguished—(1) those strictly necessary for the work, (2) those due to the worker's adaptation to rhythm of movement, (3) those due to the worker's experiences and to bad arrangements of material. The last must obviously be abolished by improved arrangement of his material.

All who have studied workers at rhythmical repetitive work have observed how frequently they insert regular accessory movements which to the observer appear quite unnecessary foı the action performed. Grosser movements of the body may be super-added which are obviously both fatiguing and needless, e.g., certain swaying movements of the body, which have been observed to persist during conversation after the rhythmical work has ceased. Some, at least, of these harmful accessory movements probably arise from bad habits early formed, due to a premature striving after high speed and output. Many others, on the other hand, may turn out to be really helpful to the worker to whose 'style' they are peculiar, and should not be condemned as unnecessary until after adequate study.

If we bear in mind that ease of movement is our first desideratum, it should be our aim to inculcate a graceful rhythm of movement and as few movements as are consonant with efficiency. Our guiding principles will accordingly be based on the following considerations:

1. Successive movements should be so inter-related that one movement passes easily into the next, each ending in a position favourable for the beginning of the following movement. The sequence of movements should be so framed that little mental effort is needed to pass from one to another and that an easy rhythm can be established for the automatic performance of the various movements of which the operation is composed, so that the mind can more readily attend to the final aim or end of that operation instead of being distracted towards the successive initiation of the several movements which are involved therein.

2. As a corollary of this principle, it follows that a continuous curved movement is preferable to several sudden changes in direction of movement.

3. It also follows that the number of movements should be reduced as far as possible, so as to encourage a rhythmical method of working. For it is clear that the greater the number of different movements composing a repeated series, the more difficult it will be to group them into a rhythmical whole. Conversely, encouragement of automatic rhythm rather than volitional direction of the worker's movements will tend to reduce the number of the movements which he will adopt.

4. The simultaneous use of both hands should be encouraged whenever possible.

5. No more effort should be used than is absolutely necessary.

6. When a forcible stroke is required, the movements and the material of the worker must be so arranged that the stroke is delivered when, as far as practicable, it has reached its greatest momentum.

13. *Individuals Require Different Best Ways*

N. BALCHIN, "Movement Study in Packing," *Journal of the National Institute of Industrial Psychology*, 5:274-275 (1931)

A study of methods of packing, made during an investigation carried out on behalf of the Institute, revealed the following interesting fact, which seems to have a bearing on the theory that there is "one best way" of performing all industrial tasks, and that this method should be adopted by all workers. The task consisted of transferring to a central box a selection of small articles from a number of large trays arranged round the packer. The objects were picked up in the right hand, placed in small individual receptacles held in the left hand (this process is known as 'cupping'), and then arranged in the box with the right hand.

It was observed that there were two distinct methods adopted. Some girls picked up each article in turn from a large tray, cupped it, and placed it in the box. Others picked up from a tray the number of articles she required from it, say four, put them down beside the box, and then cupped them rapidly into the box, thus handling each article twice, but making only one long stretch and substituting the four short movements of cupping each article from beside the box.

On taking observations with a $\frac{1}{100}$ second stop watch, it was found that the girls divided sharply into two types—those whose speed depended on the quickness of their *extended* movements,

such as stretching to take articles off the large trays; and those whose extended movements were slower, but who obtained their speed from the quickness and neatness of their more concentrated and accurate movements such as cupping.

As would be expected, timings showed that the first class were quicker if they used the method of handling each article once only, using their rapid extended movement for each article, while the second class were quicker when the number of extended movements was reduced, and the number of short movements increased, as in the second method.

It was noteworthy however, that the best method for each particular girl was *not* spontaneously adopted. In each case it proved necessary to study the girl's movements, so as to determine to which category she belonged. Once this was done, insistence on the method best suited to her gave excellent results in every case.

Some indication of the effects of the change is given by the following figures, taken from three workers chosen at random. Worker A was a first-rate packer, whose rapid extended movements suited the single-handling method, with its constant arm extensions. Worker B was a fair average performer, slower than A and better suited to the double-handling method. Worker C was altogether slower than A and B; but her extended movements were the slowest, so that she was capable of greatly increasing her speed by employing the double-handling method.

Worker	Time in Seconds 26 Articles		Per Cent Difference in Speed	Time in Seconds 47 Articles		Per Cent Difference in Speed	Time in Seconds 96 Articles		Per Cent Difference in Speed
	S.H.*	D.H.†		S.H.	D.H.		S.H.	D.H.	
A ...	114	132	13.6	187	208	10.1	400	435	8.0
B	120	105	12.5	205	192	6.3	450	429	4.7
C	160	120	25.0	265	205	22.6	480	444	7.5

* Single-handling. † Double-handling.

It will be seen that A, the fastest worker, gains over 10 per cent in speed by adopting the single-handling method. B gains by adopting the opposite method; her increases are generally smaller than A's, but they enable her actually to beat A on the first box, and bring her nearer to A's standard on the other boxes than she would have been if allowed to work by the single-handling method. Worker C shows the largest gains of the three; yet when first the double-handling method was suggested to her, she was quite certain that it would reduce her speed, and nothing would convince her to

the contrary except the detailed figures of her output before and after the change.

It is possible to claim, with some basis of truth, that one of these methods must be theoretically the better, because it involves less total movement than the other. But even if this was so, the vital point of the worker's physical make-up remains, suiting one to one method and one to another. It is easier to alter a mere packing habit than to change a physiological and psychological characteristic like speed of muscular movement.

14. *Adjusting Machine to Worker*

L. A. Legros and H. C. Weston, *On the Design of Machinery in Relation to the Operator*, Report No. 36 of the Industrial Fatigue Research Board, 30-32 (His Majesty's Stationery Office, London, 1926)

An illustration of the development of machines with respect to their saving of fatigue is afforded by the bicycle, which has been successively modified, first mechanically so as to obtain high efficiency, then psychologically so as to reduce the risk of falling and difficulty of balance, and finally physiologically so as to reduce vibration and to enable the force exerted by the rider to be more efficiently applied. The bicycle as an example is unique, because it has had the advantage of being tested in races and its effect as a means of producing fatigue has consequently been subjected to more severe trial than occurs in the case of machines that are used for industrial purposes.

The evolution of other machines has sometimes been impeded from the outset through too slavish copying of manual movements, with the result that design has proceeded to a certain point, and the machine has then required complete remodelling to work in accordance with sound mechanical principles. An example of such is found in typecasting machinery.

Actual investigation of machines has been carried out, and improvements have been designed for such cases as could be dealt with without involving great expenditure on modification of the machine.

Laundry Machines.—In the first instance, for use in connexion with investigations on laundry machines a diagram has been prepared of the elbow height of 200 girls, to serve as a guide for the optimum height at which the work should be performed.

Several types of laundry machines have been examined. In drying and ironing machines, the form of the trough containing the articles to be ironed has been investigated, and improvements suggested, as also for the height of the delivery of the machine.

Improvements have also been suggested to the Decoudun flat

iron and similar machines for the feed and delivery of the goods.

Shirt and collar ironing machines, used for ironing and polishing shirts and collars, have a pedal movement that is generally inconvenient, requiring the weight of the body to be largely supported on one foot. An improvement on this machine has been suggested, and applied in practice. By the improved arrangement, the pedal can be operated by either foot, and the operating foot can take a share of the weight of the body.

Garment presses are of much more recent origin, and are operated by a combination of hand and foot movements. The pedal movement in overcoming the toggle is performed in such manner that the foot or body of the operator is rapidly accelerated towards the end of the travel and then checked suddenly; a form of shock-absorbing device has been suggested so as to save the operator from this shock.

The cuff ironing machine is another example of bad pedal arrangement. An improved arrangement with staggered positions for the pedals would avoid the risk of contact of the foot with a pedal adjacent to the one being operated.

Leather Working Machines.—Several of the principal machines used for the manufacture of light leather leave room for improvement. The staking machine is a case of the imitation by machine of the original manual processes for treating leather.

The shaving machine is a machine of the type in which the operative stands on one foot and controls the machine with the heel of the other foot. This unusual arrangement is more peculiar because of the considerable element of danger involved in working the machine.

The fluffing machine is used for giving a soft finish to the flesh side of the skin, and producing the fine nap characteristic of suede leathers. Examples of this type of machine that were examined showed that optimum height has been disregarded in the design.

Glazing machines for smoothing and polishing the leather introduce a different element of fatigue, due to the reciprocation of the tool and its associated link-work; the presence of rapidly moving parts in close proximity to the operator's head having an effect of fascination. An improvement has been suggested in which a different mechanical motion is substituted for that at present in use, and which permits of the moving parts of the machine being enclosed.

Miscellaneous Machines: Duplex Vertical Boring Mill.—This is a large machine, capable of taking two castings up to 4 feet in diameter and machining them simultaneously. In this instance, the controls are located respectively at the outer sides of the jobs;

whereas, if located at an intermediate point, the operator could control the work without the necessity of moving from his position between the two tables.

Metal Guillotine.—In shearing light metal, the pedal of the machine travels through a variable length while cutting, and as the cut terminates and resistance is reduced, the downward motion of the pedal becomes accelerated, so that, in general, the operator receives a shock through the stopping of the pedal on the floor or a block. This is a case in which a simple form of dashpot, or shock-absorber, would suffice to eliminate the defect.

Boot and Shoe Machines.—These machines require so many simultaneous and co-ordinated movements of the operator that in some cases the use of both hands, one foot, and a knee is required. From the application of the movements, these machines may well be regarded as being in a transitory stage, and likely eventually to undergo considerable modification.

In the case of the rough-rounding machine, one leg is bent at the knee for operating the knee control, and when this is done, there is a tendency for pressure on the pedal to be reduced. A change of the foot control to the other foot might be tried.

Other Machines.—The bristle punching machine used in brush-making is an example of inadequate illumination and wrong height, causing stooping of the operator.

In the tobacco-cutting machine the delivery level is too low, also causing the operatives to stoop over their work.

In the tobacco-rolling machine, the product is out of sight of the operative, who has to reach over the machine to obtain it.

15. *Adapting Tools to Task*

F. W. Taylor, *Principles of Scientific Management*, 65-66 (reproduced by permission of Harper & Bros., 1913)

For a first-class shoveler there is a given shovel load at which he will do his biggest day's work. What is this shovel load? Will a first-class man do more work per day with a shovel load of 5 pounds, 10 pounds, 15 pounds, 20, 25, 30, or 40 pounds? Now this is a question which can be answered only through carefully made experiments. By first selecting two or three first-class shovelers, and paying them extra wages for doing trustworthy work, and then gradually varying the shovel load and having all the conditions accompanying the work carefully observed for several weeks by men who were used to experimenting, it was found that a first-class man would do his biggest day's work with a shovel load of about 21 pounds. For instance, that this man would shovel a

larger tonnage per day with a 21-pound load than with a 24-pound load or than with an 18-pound load on his shovel. It is, of course, evident that no shoveler can always take a load of exactly 21 pounds on his shovel, but nevertheless, although his load may vary 3 or 4 pounds one way or the other, either below or above the 21 pounds, he will do his biggest day's work when his average for the day is about 21 pounds. . . .

At the works of the Bethlehem Steel Company, for example, as a result of this law, instead of allowing each shoveler to select and own his own shovel, it became necessary to provide some 8 to 10 different kinds of shovels, etc., each one appropriate to handling a given type of material; not only so as to enable the men to handle an average load of 21 pounds, but also to adapt the shovel to several other requirements which become perfectly evident when this work is studied as a science. A large shovel tool room was built, in which were stored not only shovels but carefully designed and standardized labor implements of all kinds, such as picks, crowbars, etc. This made it possible to issue to each workman a shovel which would hold a load of 21 pounds of whatever class of material they were to handle: a small shovel for ore, say, or a large one for ashes. Iron ore is one of the heavy materials which are handled in a works of this kind, and rice coal, owing to the fact that it is so slippery on the shovel, is one of the lightest materials. And it was found on studying the rule-of-thumb plan at the Bethlehem Steel Company, where each shoveler owned his own shovel, that he would frequently go from shoveling ore, with a load of about 30 pounds per shovel, to handling rice coal, with a load on the same shovel of less than 4 pounds. In the one case, he was so overloaded that it was impossible for him to do a full day's work, and in the other case he was so ridiculously underloaded that it was manifestly impossible to even approximate a day's work.

16. *Best Positions of Levers for Grasping*

H. Lossagk, "Griffeldstudien" (Lever Investigations), *Industrielle Psychotechnik,* 3:274 (1926)

If one considers the sheer time required for grasping, the degree of comfort ensured, and the fatigue avoided, then single-handed grasping has an optimal angle of direction of 20-40° toward the side of the medial plane of the hand doing the work. The optimum for mechanization and accuracy lies directly in front of the mid-body. The height of the point to be grasped (when distance is kept constant) has a marked fatigue-effect; the most favorable height seems to be at the stomach level or somewhat lower.

17. *Labor Instructions for Avoiding Fatigue*

E. HESS, "Leistungssteigerung im Baubetrieb durch Arbeitsstudien" (Increased Output in the Building Trades Through Work-Analyses), *Praktische Psychologie*, 2:367 (1921)

Is it inevitable that a ditch digger should leave the work every day utterly fatigued?

No; he can maintain his vigor much more readily if he will observe the following rules:

1. Use a sharp shovel.
2. Stand so that your back is toward edge of the dump-wagon.
3. Take as full shovels as possible—there will then be fewer motions.
4. Get into such a position that the earth to be shovelled lies above the level of your feet; never stand high and be forced to lift from a depression.
5. If the track is on a steep incline, you may stand up to one-half meter above the road-bed; more than that is futile as you will then need to work with a crooked back.
6. If you have loaded the wagon in normal time, then you have a rest pause, during which you do nothing. During this time move the limbs which have not been particularly employed during the work; this serves to refresh you. Sit down if you are permitted to do so.

18. *Rhythm in Work*

H. REINHARDT, "Rhythmus und Arbeitsleistung" (Rhythm and Performance), *Industrielle Psychotechnik*, 3:226-227 (1926)

The task of the worker in this study consisted in sorting 204 metal plates, 30 millimeters square. In this collection were 15 pieces, each bearing the numbers 1 to 6 inclusive, or 90 in all. All plates numbered 1 to 6 were to be sorted into compartments in a box placed before the subject, the remaining pieces being deposited in a separate receptacle. Eight 14-year-old boys were divided into two equal groups—one worked at a free tempo, the other in accordance with an acoustically presented rhythm. Both groups worked for two hours under maximum motivation. Time and error records of the performance were taken at necessary intervals.

The method of work was as follows: Each plate was grasped with the left hand (the collection was heaped to the worker's left) transferred to the right for judgment, and then dropt into the correct compartment. From a temporal point of view, two distinct intervals could be determined, viz., the removal of the plate from

the left hand by the right, and the return of the right hand to the left. A time study of the most rhythmical worker showed that these intervals stood in the relation of 2 = 1. This corresponded to a musical triad which was presented to the test group by means of an inclined metronome. The speed of the metronome was so regulated that the subjects could follow it with the least omission of beats. For each of 10 periods the following values were calculated: 1. Number of plates sorted per min. as an index of speed, 2. Number of errors as a measure of the excellence of the work. When the average values were plotted, they revealed a pronounced superiority of the rhythmically working group. A control experiment was made 8 months later, by reversing the two groups (i.e., the group which originally worked at its own pace now followed a rhythm, and vice versa), and the results were even more strikingly in favor of the rhythmic activity.

19. *Summary of Improvements in Work Methods*

H. E. BURTT, *Psychology and Industrial Efficiency*, 136-137 (Appleton, 1929)

Unnecessary decisions are fatiguing. In assembling machinery, or packing confectionery, it proved possible to eliminate much of this unnecessary decision by supplying the worker with the parts in a prearranged scheme or by having him follow a rhythmical pattern.

Special devices or tools sometimes add to efficiency in a particular kind of work. The shape of a handle on a crank makes a difference in effectiveness of operation. Canceling letters in a post office was facilitated by a special sloping container, fluting the table, and fastening the pad, sponge, etc., in one place. In transporting loads the arrangement that interfered least with normal bodily posture proved the most efficient.

Some adjustment of the work to individual characteristics of the worker may be desirable. The height of the work relative to the individual's stature is one of these. Individual handles made from an impression of the hand so as to provide a uniform muscular pressure throughout were used in some cases. In sorting material such as mail it proved possible to adapt to individual predilection for motion in certain directions. Machine speeds may well be adapted to individual differences, for some persons can work effectively at a higher speed than others.

Rhythm introduces an economy of effort in that we do not require a repetition of the impulse for each act. The performance of an industrial operation in rhythm has sometimes been attended

with economy. Some individuals are better adapted to a more rapid rhythm than others and this has been used in selecting them for certain types of work. There is also a dynamogenic effect of a rhythmical activity—one puts more energy into the motions. It appears further that there are optimal rhythms for different muscle groups. If a motion is to be made with the foot a different rhythm is desirable from that which is most favorable with the hand. Such optimal rhythms would have to be determined in the case of any particular muscle group.

The effect of group stimulation on individual performance has been investigated. It appears that the person in a group does more than when working alone. However, it is interesting to note that it is the inferior individuals who profit most from this stimulation. Further, when working in pairs, but each doing his individual task, one seems to profit more from the presence of a good rival. In team work of a more motor character where both are coöperating in the same task, the most effective arrangement was with one person rather distinctly superior to the other so that he set the pace. When both were about equal there was a tendency for both to try to lead.

The nature of the stimulus or signal to which the worker reacts influences the speed of his reaction. An auditory signal produces a quicker reaction than a visual. Moreover, if the person is attending to the signal his reaction is slower than if his attention is directed toward the proposed motion.

QUESTIONS

1. Describe in detail the operations performed by Gilbreth which led to the perfection of the autostereochronocyclegraph.
2. What are the principal differences in viewpoint and procedure between the old-time "efficiency engineer" and the contemporary industrial psychologist when working on a common problem such as time and motion study?
3. Analyze the concept of "efficiency" and show just where questions of psychology appear.
4. Draw up a list of all common household appliances (such as kitchen sink, refrigerator, etc.) which could be improved if the designer had thought more of the user's comfort. Submit your criticism in detail.
5. Analyze the keyboard of a standard typewriter. Is it scientifically constructed? Could it be bettered from the user's viewpoint? (Hint: consider the placement of the keys with reference to frequency of pressure by right or left hand.)

6. Why is there not a "one best way" of doing everything?
7. What changes do you think Taylor and Gilbreth would have made in their schemes of management had their education included a little psychology?

CHAPTER XI

FATIGUE AND REST PAUSES

Weariness is one of mankind's great burdens; unnecessary weariness is an unmitigated ill. Without indulging in any of the subtleties of the mind-body problem, it is easy to appreciate the rôle of the psychic factor in fatigue. Everyone knows that sheer bodily tiredness creates a distaste for the labor which induced it; but it is too often forgotten that distaste for the work may create premature fatigue.

Much of the old-fashioned industrial leader's thinking on this problem was based on a primitive mathematical analogy. If 5 units of work could be done per unit of time, then 5 x 4 units could be performed in 4 hours, 5 x 8 units in 8 hours, 5 x 12 units in 12 hours, and so on. In fact, political economists a century ago argued that the profits of the owners were only made possible by the last few hours of work. Needless to say, this was often used as an excuse for keeping young children at work sixteen and eighteen hours daily. The fallacy lies in the fact that while man may be a *mechanism,* he certainly is not a *machine*—at least, not a machine whose rate of work remains uniform over long periods of time. He needs sleep, recreation, and the satisfaction which comes from exercising unused instinctive dispositions. If deprived of them too long, man grows restless, "disgusted," weary, and inefficient. An awareness of this marks the difference between the psychological and the physical approaches to problems of output.

It is therefore no paradox that where the eight-hour day has displaced longer shifts, both daily and hourly production generally increase. The reason is simple. If we are confronted by a long work-day, we tend to "save" ourselves and consequently spread our energies out thin throughout the shift. Where the work-spell is relatively short, there is no necessity for thus husbanding one's reserves and hence we labor with greater vehemence.

Just as a shorter work-day wards off cumulative fatigue, so

the rest pauses are designed to remove the effects of temporary fatigue. That they are a blessing to the worker and a profit to the employer is acknowledged by all those competent to interpret the evidence. Nevertheless, every factory must experiment with its own operation until it finds the type of rest pause best suited to its needs. Such questions as the length of the pause, the way it should be occupied, how frequently it should recur, who should take it, etc., are all matters which require adjustment to the individual plant.

The personal and social gains which come from a diminution in industrial fatigue are almost too obvious to mention. Domestic life is often rendered intolerable by members of the household who are too weary to be decent. Night schools find much of their teaching neutralized because the students' minds lack the freshness of tone which is most appropriate for learning.

A. The Facts of Industrial Fatigue

1. *Factors in Fatigue*

C. S. Myers, "The Study of Fatigue," *Journal of Personnel Research*, 3: 321-334 (1925); reprinted by permission of Williams & Wilkins Co.

In approaching the subject of industrial fatigue, it will be well first to summarise our knowledge of fatigue as derived from laboratory experiments.

The Nature of Fatigue.—The muscle-nerve preparation served as the first instrument for inquiry into muscular fatigue. It has provided us with data which strongly suggest that each striated muscle fibre when stimulated responds by an all-or-none contraction; that is to say, if the stimulus is but sufficiently strong to produce a contraction, the muscle fibre contracts to the same extent, however strong be the stimulus. We have reason to believe that the muscle fibres while at rest secrete within them a store of material, in the form of glycogen, ready to break down, on or after the application of a suitable stimulus, into lactic acid, carbon dioxide, etc., a decomposition which is associated with contraction, the generation of heat and the production of electrical changes. It is conjectured that different muscle fibres within any one muscle show different degrees of irritability, so that while a weak stimulus is only able to affect a few muscle fibres, a strong stimulus will involve a larger number of fibres, the degree of contraction of the

whole muscle thus being determined by the number of muscle-fibres which are at that moment in a state of contraction.

Study of the muscle-nerve preparation has further taught us that the response of the muscle-fibre is not only determined by the amount of stored material available but also by the rate of removal of the products of decomposition of that material. To these two factors—loss of explosive material and accumulation of its katabolic products—have been generally attributed the phenomena of muscular fatigue, i.e., the loss of response to stimulation consequent on repeated muscular exercise.

The muscle-nerve preparation also indicated that the end plate—the structure in which the nerve-fibre terminates at the muscle-fibre—is more readily fatigued than the muscle-fibre itself, blocking the transmission of the impulse from nerve to muscle at a time when the muscle-fibre is still responsive to a stimulus applied to it directly.

The Importance of Inhibition.—Then came experiments on the intact organism by means of the ergograph, an instrument ideally recording the voluntary contractions of a single muscle—a series of flexor movements at a single knuckle joint, involving the lift of usually a relatively heavy weight. In these conditions fatigue appeared to be largely due to inhibitory nervous impulses ascending from the muscle to the central nervous system, and making it more and more difficult for impulses to descend to that muscle which would otherwise throw it into contraction. Some of these ascending impulses from the exercised muscle affect consciousness in the form of discomfort, pain or cramp, but others act purely reflexly, blocking the path of outgoing impulses, thus inhibiting voluntary movement. Hence when volition is powerless to evoke further ergographic records, they may still be obtained by stimuli applied on the skin surface to the motor nerve running within the limb to supply the muscle whose contraction is being studied.

The importance of nervous inhibition in safeguarding our striated muscular system from exhaustion is also seen in certain conditions of general fatigue or in certain stages of the influence of alcohol. The higher nervous levels appear normally to exercise an inhibitory influence over the lower, which may disappear in fatigue and under the influence of alcohol. Such loss of higher control may manifest itself temporarily in an increase in the amount of muscular work performed. Hence higher fatigue does not necessarily imply immediate reduction of muscular work, although it involves all the consequences of lessened control—first, loss of that delicate coördination of movements associated with

the higher nervous levels, and second, extravagant expenditure of muscular energy.

Ergographic and muscle-nerve experiments also indicated the importance of rest pauses in relation to recovery from the effects of muscular exercise, a far greater total amount of work being elicitable when more frequent rests were introduced.

The Work Curve.—Next came laboratory experiments into mental fatigue, which consisted essentially in the study of curves of output recorded minute by minute, or five minutes by five minutes, during an hour or more's mental work. This work was of a simple uniform character, e.g. adding pairs of figures, or erasing a prescribed letter throughout a printed text. Here, again, the value of rest pauses on subsequent output was demonstrated, and attempts were made to determine the most favorable length of rest pause for a given period of mental work. But the chief value of such experiments lay in the analysis of the work curve, which brought to light the play not only of practice and fatigue, not only, that is to say, of the acquisition of skill and of the loss of efficiency produced by exercise, but of (*a*) incitement, the warming up of the subject to his work after he had been withdrawn from it, (*b*) settlement, the neglect of distracting conditions—and (*c*) spurts, of which the most striking are the initial spurt when the subject starts fresh to his work, and the end spurt when he realizes that the end of his work is approaching.

Factory Fatigue.—Valuable as have been the results of these laboratory experiments, they have proved far from adequate in their practical application. The conditions of laboratory experimentation are widely removed from those of work-a-day life. Muscular fatigue cannot be isolated in the factory, as in the laboratory, from such influences as skill and intelligence which depend on the proper functioning of the highest levels of the central nervous system. The most unskilled labour is really skilled, in the sense that there are good and bad methods of carrying it out. Further, a worker's movements cannot be compared with the movements of the subject of an ergographic experiment who lifts his finger repeatedly and rhythmically with the utmost force and to its utmost extent until he can move it no longer. The worker knows better than to exhaust himself in a relatively brief period by employing his utmost energy; he regulates his output according to his feelings of fatigue and according to the length of the period over which he has to work.

Variations of Output.—Thus it comes about that, whereas in laboratory research feelings of fatigue are not incompatible with a temporarily increased output of work, owing to the removal of

normal inhibitory influence, in everyday life, as Muscio's experiments have indicated, such feelings are more closely related to the varying output throughout the day. Moreover, as he has also shown, even when no work has been done, a worker's efficiency, as demonstrated by interpolated tests, varies at different hours, the efficiency curve in a resting worker being similar in form to that revealed by actual work throughout the day but at a higher level.

Adaptations to Length of Day.—The adaptation of the worker to the length of the working day has been well demonstrated by Vernon in his observations on the effects of changes in the length of the working hours. An improvement in rate of output almost invariably results from shortening the working day; but generally it does not occur immediately, or at all events it does not attain its maximal effect immediately. Weeks or even months may elapse before the full beneficial effect of the reduction of hours on rate of output is reached. The output continues slowly to rise for a period varying, apparently, with the kind of work involved, and varying no doubt with the worker, until uniformity is again established. This can hardly bear any other interpretation than that the worker consciously or unconsciously adapts himself to the length of his day's work or of his work spell or shift. Hence, when that length is suddenly shortened, some considerable time is needed, during which he changes his rate of output, before he can adapt himself completely to the new conditions of work.

There is no doubt a complexity of other factors determining this change in rate of output. Thus, the worker's output is consciously or unconsciously influenced by that of his fellows and by the tradition of the factory. For this reason, the speed and extent of improvement in rate of output in a shop must depend on those who initiate it. By force of suggestion if they are workers who have prestige among their fellows their action will be more or less unconsciously imitated, whereas workers of inferior standing will arouse resistance rather than coöperation. But, apart from such complicating factors, the broad conclusion we are justified in reaching is that more or less unconsciously the industrial worker regulates his rate of output, according to the length of his working spell or day.

In this connection, it is interesting to observe that whereas adaptation to shortened periods of work is slow, adaptation to lengthened periods is quick. Thus, in the case of mill men engaged in the tinplate industry, while it took eight to ten weeks to reach the maximum of output after a change from an eight-hour shift to a six-hour shift, on reversion to the eight-hour shift the output

fell at once approximately to its previous level without any appreciable period of adaptation.

But apart from the fact that the worker does not, like the ergographic experimenter, continually put forth his utmost power, he differs further in the fact that he is not always using the same joint or the same muscle. He varies his posture as he begins to feel discomfort, now using one set of muscles, now using another, for the same work, so that the previously used set may regain their freshness. Moreover, he is not contracting his muscles against so heavy a weight that in a relatively small number of lifts it is likely to produce complete impotence to execute further contractions.

Monotonous Work.—Similar objections hold in the case of laboratory experiments in mental work, where, again, the subject is working his very hardest for a relatively short period of time, and the work performed is of the most uniform monotonous character, so uniform, indeed, that after a little practice, it is at times carried on quite unconsciously. If monotonous work in industry can be called—as I think it should be called—mental work, then the laboratory experiments are to that extent comparable with the monotonous conditions of industrial life. But they are clearly incapable of throwing much light on fatigue in work which demands the continual conscious exercise of intelligence.

Adaptation.—This brings me to a further difficulty, depending not on the inapplicability of laboratory experiments to industrial conditions, but on the incompleteness of our knowledge of fatigue derived from experiment itself. It is impossible to believe that in such experiments as I have described we have the whole story of fatigue.

No doubt, in ergographic and in heavy muscular industrial work, pain or discomfort are largely instrumental in inhibiting further activity. But these are protective only. If they be disregarded, or if such feelings become blunted, further activity is possible. Moreover, increased interest, excitement, the influence of emotion or suggestion, may, as is well known, either prevent fatigue from manifesting itself or lead to a revival of muscular or mental activity. Let us endeavor to form some idea of how this occurs.

Muscular contractions, and acts of apprehension, decision and the like are one thing. They may perhaps be regarded as explosive acts fired off much as a heat spot fires off, so to speak, its sensation, and then requires rest for recovery. But these contractions and acts occur in a setting of tone, posture, and attitude, perhaps much as the heat and cold sensations appear to occur in a setting of sensibility to warmth and coolness. The muscular contractions and mental acts are of an intenser, more momentary character, readily

susceptible of fatigue, whereas muscular tone and posture, and mental attitudes are of a milder, more prolonged character, far more resistant to fatigue.

Sources of Fatigue in Mental Work.—We can endure the light of a northern summer for hours without fatigue: adaptation appears to enter in its stead. We can maintain a given posture likewise for a prolonged period: adaptation appears to step in, coördinating activity within pairs of antagonistic muscles, and perhaps setting up some "give and take" between them. It is this process of adaptation which finally tires. In mental work it is the ability to preserve the right attitude that finally tires, then making further mental work disorderly and useless. Of this kind of fatigue we know practically nothing. When we are engaged on a given piece of mental work—let us include even the repeated addition of pairs of figures and muscular work, for even this, I would insist, involves mental work—all conflicting nervous impulses must be inhibited, other distracting ideas and other muscular movements must be suppressed in so far as they are incompatible with the work at hand. Such inhibition in itself involves work. I know of no physiological evidence to support McDougall's view that inhibition is merely the result of the drainage of energy into other channels which are simultaneously active. The suppression of conflicting emotional states in psycho-neurotic conditions affords an adequate example of how active a process inhibition is. But this inhibition of incompatible attitude though it may last a long time, cannot continue for ever. It becomes more difficult, partly perhaps through nervous blocking, partly because the inhibited or repressed attitude and acts gain in strength and finally insist on manifesting themselves by bursting through the restraint imposed upon them.

Boredom and Fatigue.—We thus gain some idea of the place of boredom in our conception of fatigue. An attitude may be maintained, at first, by interest, the work being intrinsically and spontaneously attractive. Later, volitional acts have to be employed to maintain this attitude, and as these become more difficult and more ineffective, the feeling of interest gives place to one of increasing boredom.

It is naturally the most delicate and latest acquired functions that suffer most in mental fatigue. In the work of adding pairs of figures, it is not so much the speed or accuracy of the reaction to 2+1 that becomes impaired as the ability to attend to and to apprehend the meaning of this presentation. Reaction times are in themselves poor indices of fatigues. What suffers is the inability to preserve the proper attitude.

The more intelligent the worker the more irksome becomes

monotonous work, the more difficult becomes the maintenance of the required attitude, because of the demands of his intellectual processes. An interesting illustration of this is afforded by a recent investigation by Miss I. Burnett who in a laboratory experiment engaged four unemployed work girls in the daily repetitive work of cross-stitching throughout two months. Of these four girls, two had been rated by an intelligence test as highly intelligent, the third showed average intelligence and the fourth was distinctly below the average in intelligence. Each of the first two girls showed distinct signs of boredom in the work; the one was restless and yawned, seizing every opportunity for change of posture and engaging far more often than the others in conversation, while the other confessed that she found the work "very tedious and would not like to do it regularly." These two most intelligent girls "were capable of reaching a high output from time to time but were unable to maintain it." The worker who was rated third in intelligence did by far the best work, 12 and 16 per cent respectively more than the two girls who were rated highest in intelligence. She declared at the end of the experiment that "so far from experiencing any strain of monotony as a result of the repetitive work, she had rather liked it." Her regularity of output, too, was far greater than that of any of the other girls, 14 and 25 per cent greater than the two most intelligent, and 22 per cent greater than the least intelligent. The latter showed very considerable improvement with practice but made a very bad start and appeared hampered by clumsiness, holding the needle with difficulty, and picking it up with difficulty from the floor on to which she frequently dropped it. She offered no objection to the repetitive work, but complained of the occasional conversation of the other girls.

The practical outcome of these experiments is that monotonous work requires a certain degree of intelligence, but that it suffers appreciably if too great intelligence be brought to bear on it. Such ill effects may be safeguarded, as we shall see, by rest pauses and by changes of work. They may also be prevented by recourse to day-dreaming and in certain circumstances, especially when the work is rhythmical, by refuge in song.

Effects of Varying Work.—In some laboratory experiments on the effects of varying work, carried out by Wyatt on three young adults during two daily spells of 2½ hours each, lasting over six weeks, the output increased by amounts varying from 2.4 to 24.2 per cent. The errors decreased by amounts varying from 9.2 to 55.1 per cent (according to the subject and the work), when the nature of the work was changed at about fifty-minute intervals.

The work was of three kinds—adding in the head sets of 5 digits, adding, by means of a comptometer, columns of 10 digits, and pulling every half-minute against a powerful spring balance with the right and left hands alternately. During three of every four days one or other of the three tests was worked continuously. On the fourth day each spell was divided into three periods of fifty minutes, and the three tests were consecutively given during the three periods. The results, as I have said, varied according to the worker and his liking for the work performed.

On the other hand, too many changes of work must obviously have a deleterious effect on output. In a manufacturing chemist's work, an increase of from 17 to 20 per cent in wages earned was found by Wyatt to occur when the operative changed approximately every half-hour from one process to another instead of, as before, carrying out from 100 to 250 different changes of process in the course of the day, giving an average duration of from two to five minutes for each process.

Rhythm.—Closely allied to preservation of the right attitude and posture is preservation of the proper rhythm and of due coördination of the various movements that make up an operation. Just as the members of a boating eight become "ragged" in fatigue, using useless energy with relatively useless results, so the tired worker "falls to pieces;" his rhythm and skill suffer.

In the operation of roughing, i.e., removing scratches and imperfections from spoons and forks, which are pressed for the purpose against a rotating wooden leather-covered wheel, oily sand being allowed to fall between the wheel and the article that is being roughed, Farmer and Brooke estimated by means of a recording watt meter, the number and duration of strokes, the pauses between the strokes and the pressure of the strokes against the wheel, as the output fell off from fatigue. They found that the number of strokes per spoon, the duration of those strokes, and the pressure with which the strokes are applied increased towards the end of the spell in spite of the fact that, at this time, when output is actually diminishing, fatigue may be supposed to be present. As they express it, the tired worker is "not only working slower than when she is fresh but is expending her energy extravagantly."

The number of strokes per spoon remains nearly constant during the morning; which is a fair indication of the maintenance of a steady rhythm. It is during the afternoon, especially towards the end, that the greatest variations occur. Just as when interest fails, constant volitional efforts have to be employed to maintain the requisite mental attitude, so when the natural rhythm fails through fatigue, conscious efforts have to be invoked to carry on the work.

It is in this sense that I ally rhythm with muscular posture and mental attitude. All three can be prolonged for some considerable time before fatigue sets in. All three may be regarded as a kind of matrix in which mental and muscular acts are set. All three require for their maintenance a directive activity which ultimately tires—an activity of the nature of which we know no more than we do of that directive activity of which it is an expression—that activity which *par excellence* distinguishes animate from inanimate nature.

Abnormal Fatigue.—Fatigue, in the sense of a diminution of efficiency owing to prolonged exercise, is of course a normal and healthy result of all work; it can only be considered serious and abnormal when after the rest which follows any given spell of work, it is not almost wholly dissipated. For then, spell by spell, day by day, the fatigue effects accumulate and the time must sooner or later arrive when healthy fatigue is replaced by pathological exhaustion.

Taking the daily industrial work curve and comparing it throughout the week, we actually find evidence sometimes of such accumulation of fatigue, but in general, it is practically dissipated by the week-end rest.

The amount of fatigue during the week varies with the skill of the worker. In the boot and shoe industry, for example, the most expert operative's record was found to rise throughout the week, whereas in some instances the poorer worker's began to fall from Wednesday or even earlier onwards.

The influence of fatigue may be masked by spurts. Thus in silk weaving the best output occurs between Thursday morning and Friday noon, which is the "making-up time" for calculating the wages to be paid on the week's work. The approach of an annual holiday when the maximal piece-rate earnings are coveted, may lead to a similar spurt.

Length and Distribution of Periods of Work and Rest.—The earliest attempt in Great Britain to deal systematically with the problems of industrial psychology which arose during the recent war were made by the Health of Munition Workers Committee. They concerned the proper length and distribution of periods of work and rest. There were times during the war when in Great Britain munition workers worked nominally for 74½, actually for about 66 hours a week. In one case, for example, 63½ hours were actually worked by women engaged in the moderately heavy work of turning fuse bodies. When their weekly hours of actual work were reduced from 63½ to 47½, their total weekly output rose by 13 per cent. An even greater increase in weekly output, an increase of 19

per cent followed the reduction of hours actually worked from 58.2 to 50.4 per week in the case of men engaged in the heavier work of sizing fuse bodies. Not only was the output thus increased, but a reduction in the amount of lost time through sickness, slackness, etc., also resulted. Thus in a shell factory the time lost fell from 11.8 to 6 per cent after the hours of work had been reduced from 63¼ to 54 per week; while later in the iron and steel industry a reduction of the hours of work from 53 to 48 per week was followed by a reduction in lost time from 2.46 to 0.46 per cent of the working hours.

Working Hours in Munitions and Glass Works.—But although the total weekly hours now worked in Great Britain do not generally endanger serious fatigue, we are nevertheless confronted with the important problem of the best distribution of those hours so as to secure the *maximal efficiency* (which includes the maximal health and contentment) of the worker. During the war a comparison was made by the Industrial Fatigue Research Board between the output during twelve-hour and eight-hour shifts among women workers who were engaged in cutting off the ends of the roughly forged shells. It was found that that part of the work which was dependent on the worker and independent of machinery, and which was performed in 100 minutes of the long-shift system was accomplished in 80½ minutes when the short-shift system was adopted. That means a 19.5 per cent improvement. Vernon has since studied the output records of four British factories in the tinplate industry. The hourly output during four-hour shifts was found to be 11.5 per cent greater than when eight-hour shifts were worked. Moreover, under this shorter-shift system the output no longer showed the serious fall at the end of each day, which occurred in the longer-shift system. Finally the amount of lost time was less.

In certain glass works in Great Britain Farmer recently found that the hourly output increased by about 10 per cent when eight-hour shifts were substituted for ten-hour shifts. There was also an appreciable reduction in spoilt work and decrease in lost time when the shorter shifts were introduced. The increase in rate of output in the eight-hour shift was not in itself large enough to make the output equal to that in the ten-hour shift, but as the eight-hour shifts allowed of a twenty-four-hour use of the plant, the total daily output was higher than when the ten-hour shifts were employed, which involved only a twenty-hour use of the plant daily.

Length of Rest Pause.—The most favorable length of the rest pause, and the most favorable point of its introduction can only be determined by careful expert analysis of the work curve. As

the laboratory work of the Kräpelin school has shown, they vary with the worker, with the nature of his work and with the duration of its spell. In a boot and shoe factory it was desired to increase the output without adding new machinery. This was effected by allotting to each double press three, instead of the usual two, girls; each of the three working for forty minutes in each hour, and resting the remaining twenty minutes. An increase of output was obtained in the six presses worked, amounting to 45, 43, 57, 39, 43 and 75 per cent respectively, the average increase of output for the six presses being over 44 per cent. The presses showing the highest increase were those worked by the least skilled operatives, in whom fatigue was doubtless most prevalent. Lost time and sickness were diminished, and a spare girl was always at hand in emergency to take the place of an absent member of the team.

Time Required for Improvement of Output.—Save in exceptional circumstances, however, the introduction of such lengthy periods of rest must prove impossible. On the other hand, the value of shorter rest pauses has been repeatedly demonstrated.

Vernon has brought forward evidence to show that several months may be needed before the full effect of rest pauses may be reached. Thus in an experiment on girls making bicycle chains, it took six months. In one on labelling, it took ten weeks. Vernon has here again shown that rest pauses produce their maximal effect on the slowest workers. Thus when girls engaged on labelling were divided into three groups according to their speed of work, a ten minutes' rest effected an improvement of 8 per cent in the quickest third, one of 17 per cent in the slowest third, and one of 13 per cent in the middle third.

Breaking Long Work Periods.—There can be no doubt that in by far the majority of operations, the efficiency of a spell of work exceeding four hours can be improved if divided into two halves separated by a few minutes' pause. Again and again, workers have testified to their appreciation of such a rest interval. The work curve is thereby not only raised in height but is also improved in form. We shall presently have occasion to examine the various forms of work curve. At the moment I wish to indicate by actual example, from an investigation at the National Institute of Industrial Psychology, how a daily work curve may be improved in form. In the following instance, before the rest pause was introduced, the work curve, averaged from a number of workers, showing the output for each half-hour throughout the day, rose until 9:30 A.M., remaining at the same level until 11 A.M., then declining, next rising from 12 to 12:30 probably through the influence of endspurt, and finally falling slightly until 1 P.M. when there was an

hour's break for dinner. After a rest period of seven minutes had been introduced at 11 A.M., not only was the curve throughout at a higher level, but the level was much more uniform than in the previous curve, indicating perhaps a lessened call on excessive voluntary effort, and more orderly, rhythmical method of work. In the afternoon work curve, under both conditions a spurt occurs at 4:30; but where the rest pause was introduced (at 4 P.M.) the improvement was maintained and the curve continued to rise right up to 6 P.M., the end of the day's work, whereas, before the introduction of the rest pause it fell during the last half-hour. When no rest pause was interpolated at 4 P.M., the work curve fell sharply from 4 to 4:30; but after the seven minutes' rest had been introduced at 4 P.M., the work done during the remaining twenty-three minutes of the half-hour actually exceeded that done in the same half-hour when no rest pause was interpolated. Despite a 3 per cent reduction in total working hours due to the pause, a more than 5 per cent increase in output, with less fatigue to the worker, resulted. The workers greatly appreciated the pause.

In another experiment an increase of over 14 per cent in output was obtained by the introduction of a fifteen minutes' interval in the morning and the afternoon, which the workers, engaged in another factory on the same work as that referred to, spend mainly in a change of work, not merely in rest. They spent the pause in collecting materials, a task which had been previously carried out partly during the first few minutes of each morning's work, partly distributed irregularly throughout the remainder of the day. The output curve showed an enormous improvement in form as well as in height. The workers were unanimous in their approval of the change.

Improvement Before Rest Pause.—That a rest pause may also show an improvement of output not only after but also before the pause is indicated by the following data obtained by Wyatt and Ogden in a laboratory experiment consisting of adding series of 5 digits during morning and afternoon spells of work. The percentage increases of output owing to the rest pause were:

	Morning	*Afternoon*
Before the pause................	12.1	19.8
After the pause..................	20.5	24.1

Interpretation of Work Curves.—A well-shaped curve should not show too many irregularities, for these indicate the excessive play of voluntary effort and inadequate help from habit and rhythm. It should not decline too greatly towards the end of the spell of work, for this indicates excessive fatigue. Irregularities, initial

rises and final falls there must always be; an absolutely flat curve is unobtainable. End-spurts may or may not be present, but they are so variable in occurrence that they cannot in general be considered as diagnostic of a good or bad form of work curve.

Farmer has recently attempted to indicate the conclusions which may be drawn from changes in the shape and level of the work curve due to a change of conditions. First, the curve may remain the same in shape but be on a higher level. This he regards as signifying that a greater output has been obtained under the new conditions with the same amount of effort, and with the same fatigue effect of the day's work. Second, the curve may keep practically on the same level but now be of a far better shape. We may then infer that the operation has been facilitated by the changed conditions in the sense not that it can be performed with greater speed, but that the cumulative effects of its repetition are less fatiguing than in the original method. Third, the curve may be on a higher level but of a worse shape. Here we may assume that the increased output has resulted from a quicker and more fatiguing method of working, such as may be expected when methods of speeding up are introduced with little regard to the health of the worker. Lastly, the curve may be on a higher level and also of a better shape. When this occurs, we are no doubt justified in considering that it indicates an easier, speedier and less fatiguing method of working, yielding a higher output with less fatigue to the worker, despite the fact that he is repeating the operation a larger number of times during the day.

Variations Due to Individual Reaction and Type of Work.—But it must be remembered that, under otherwise similar conditions, the ideal work curve cannot be realized for *every* worker and for *every* type of work. Some individuals work better in short stages and by spurts, others over longer periods and more uniformly. The rest pauses which increase the output of some workers will, as has been shown by research in this country, reduce the output of others. Moreover, some types of work are characteristized by considerable muscular fatigue. In these the work curve must be expected to fall considerably towards the end of the morning's work, to show a fair recovery after the mid-day break, followed by a progressive, well-marked fall throughout the afternoon. On the other hand, operations requiring skill and dexterity would be expected to show a work curve rising slowly in the morning to a maximal peak, as the worker settles to his work, followed by a less obvious fall (adaptation preventing or outweighing fatigue), a less complete recovery after the mid-day break (owing to loss of adaptation), and a smaller decline towards

the end of the afternoon. Again, the work curve of operations characterized by rhythmical movements may be expected to show a good increase during the morning as the worker settles down to his rhythm, after which the output is relatively well-maintained throughout the rest of the day, provided that the hours of work be not excessive.

All these expectations have been verified in an inquiry conducted on behalf of the United States Public Health Service. The stability of output occurring in the case of rhythmical work was found to be still greater in machine work, a steady rise occurring up to the third or fourth hour of the day, after which there was little variation in the rate of production. But, as would be expected, these curves varied in shape according as they were obtained from an 8-hour plant or a 10-hour plant, those from the latter showing a slower rise in the morning, and an earlier and greater fall throughout the afternoon.

Characteristic Curve for Monotonous Work.—Attempts have been recently made to claim that a special form of curve is apt to appear in monotonous work, the worker coming fresh to it at the start of the spell, then becoming bored with it and finally looking eagerly to its termination as the end of the spell draws near. The curve of monotonous work, if this claim be substantiated, falls in the middle of the spell and is higher on either side of it—thus being absolutely inverse in shape to the "normal" work curve which reaches its maximum not far from the middle from the spell of work.

Effects of Working Conditions.—Lastly I must draw attention, however briefly, to the importance of such influences as lighting, humidity and temperature upon output.

The work of Wyatt, Weston and Elton has shown that in the process of cotton-weaving the use of artificial light reduces output by 5 per cent, and that in the more delicate processes of silk and fine-linen weaving it reduces output by 10 and 11 per cent respectively.

In fine-linen and in cotton-weaving Weston and Wyatt have shown that owing to the discomfort and fatigue of the weavers, efficiency falls when the wet-bulb temperature rises beyond about 73°F., despite the fact that a higher temperature and a higher degree of humidity are favorable from the point of view of their physical effects on the manufacture of the material.

The effects of temperature on output are indicated by the data of seasonal variations obtained by Vernon in the iron and steel industry and by Farmer, Brooke and Chambers in the glass industry.

The Complex Character of Fatigue.—I have said enough to indi-

cate the impossibility of defining fatigue in a way satisfactorily for the application of any tests devised to measure it. The interpolation of a test inevitably introduces a change of attitude and a change of interest or the complication of some other feeling. The subject may be gratified, be annoyed, or, as is sometimes the case, apathetic, at being called away from his daily work to the test. He may be amused or alarmed at the apparatus which is applied to him or remain completely passive. Also, he may become bored with the test, to which he is repeatedly submitted. Such influences, varying at different times and in different persons, cannot fail to affect the results of a test even when it is of such a character that the worker cannot voluntarily control his behavior to it, as is the case, for instance, in measuring cardiac, vascular, or respiratory activity. If, on the other hand, the test be opened to the voluntary control of the subject, e.g. a dynamometer test or a test of adding figures, dotting circles, or erasing a prescribed letter from printed matter, we are dependent almost entirely on the conscientiousness of the subject for our belief that he is always doing his best at the test.

If we continue to use (and it is almost impossible to avoid using) the term fatigue in industrial conditions, let us remember how complex is its character, how ignorant we are of its full nature, and how impossible it is in the intact organism to distinguish lower from higher fatigue, to separate the fatigue of explosive acts from the fatigue of maintaining attitudes, or to eliminate the effects of changing interest, excitement, suggestion, and the like. In industrial psychology, our hope lies rather in the study not of fatigue tests but of the curves of actual output, endeavoring to analyze the various influences at work and to observe, by the comparison of curves obtained under different conditions, how industrial efficiency may be improved.

2. *Solving a Production Problem*

ANONYMOUS, "Fatigue in Intensive Work," *Iron Age*, 93:1097 (1914)

At a session of the Efficiency Society held January 27, to discuss methods of introducing scientific management in the foundry, Arthur Brewer, superintendent, Bridgeport Brass Co., Bridgeport, Conn., mentioned the following instance of the value of considering the fatigue factor in intensive work:

We had constructed a large Hurley cumulator. A part of this cumulator was some 40 or 50 feet up above the railroad track. We first figured on putting up an elevator; and then we decided that it would be best to put up an incline. We began a long incline

from the foot to the top of the cumulator. I haven't the precise figures for the grade. We made a premium rate based on the information we had as to the length of time it took the man to wheel a barrow from the bottom to the top; the length of time it took to roll on the level, going up a certain incline, and the time it took them to turn around and come back. We arranged a premium rate which we deemed was correct, and the men were put to work. I may say that all our men are now accustomed to the premium rates.

They started on this particular work and by noon they were exhausted. In short, they had not made good, and it was very evident that their rate was bad. A man who was well-versed in these matters investigated, and in five minutes he discovered the difficulty. The men were working too hard.

Finally, we arranged for the foreman on the cumulator to blow a whistle at certain intervals, and we set a clock where he could see it, and at intervals—I believe it was 12 minutes—he blew the whistle, and the men on the work would stop where they were, sit down on the wheel-barrow and rest two or three minutes. When the foreman blew the whistle again they would resume work for another 12 minute period. The first hour of work showed a remarkable change and the second day they made a very good premium allowance, and the third day they made some forty per cent premium.

We found that if a man is allowed to go ahead at his own pace he does not realize how much rest he requires. He is anxious to get the premium and he works so hard that by night he is exhausted.

3. *Simple Alteration in Hours of Work*

H. M. Vernon, *Speed of Adaptation of Output to Altered Hours of Work*, Report No. 6 of the Industrial Fatigue Research Board, 5-8 (His Majesty's Stationery Office, London, 1920)

Output in the tinplate industry was studied in respect of the millmen. The rolling of red hot tinplate "bars" into thin plates of steel, which are subsequently tinned, is a continuous process lasting from Monday morning till Saturday afternoon, and the millmen usually work three 8-hour shifts per 24 hours. If there is a breakdown of machinery or a shortage of material they may be made to work four 6-hour shifts, or occasionally, six 4-hour shifts, and I obtained output data under the two systems of shift at four different factories. The data are subject to two variable conditions. Firstly, owing to the strenuous character of the millmen's work, there is a seasonal variation of output, and on an average output varied from a maximum of 104.4 in January to a minimum of 94.0 in

August. This variation was corrected for by dividing each week's output by the appropriate average output of the month. Secondly, the quality of the output produced (expressed as "weight of boxes" of tinplate) varies somewhat from day to day and from week to week, and though I was able to correct the data obtained at two of the factories for this variable I could not do so at the other two factories. At one of these two latter facories the weekly output per mill was ascertained for six years, and during this period the men went on to 6-hour shifts for periods of 6, 8, and 19 consecutive

TABLE I

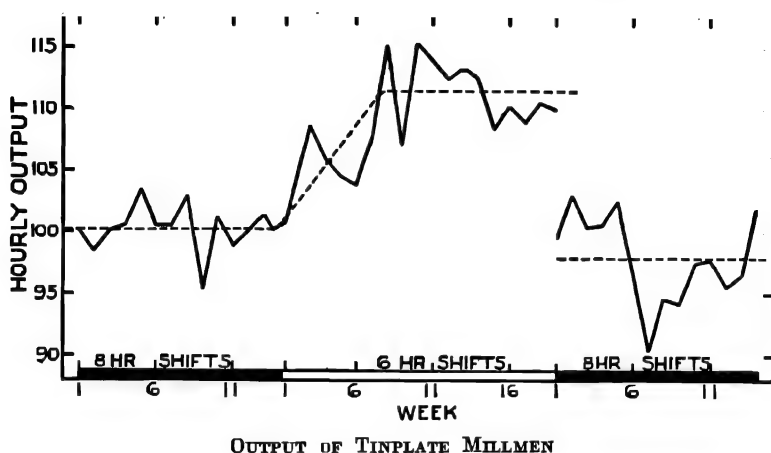
HOURLY OUTPUT OF TINPLATE MILLMEN

Week	Preceding 8-Hour Shift Period		Intermediate 6-Hour Shift Period		Succeeding 8-Hour Shift Period	
1st	100.1		100.7		99.5	
2nd	98.5		104.1		102.9	
3rd	100.1		108.6		100.3	
4th	100.6		105.8		100.5	
5th	103.5		104.5		102.5	
6th	100.4		103.8		96.1	
7th	100.5	100.2	107.4		90.4	97.9
8th	102.9		115.1		94.7	
9th	95.3		107.0		94.3	
10th	101.2		115.3		97.0	
11th	98.8		113.8		97.7	
12th	100.0		112.4		95.5	
13th	101.3		113.3	111.4	96.4	
14th	100.1		112.4		101.8	
15th			108.4			
16th			110.2			
17th			108.9			
18th			110.5			
19th			110.0			

weeks. In the other factory the output was accrtained for 4⅓ years, and the men went on to 6-hour shifts for periods of 7, 24 and 75 consecutive weeks. I have averaged these six sets of data, and in Table I are recorded the relative hourly output values during the 14 weeks immediately preceding the reduction of hours when 8-hour shifts were worked, during 19 weeks when 6-hour shifts were worked, and during the 14 weeks immediately following the change of shifts from 6 hours back to 8 hours. The 6-hour shift values are the averages of six sets of data only for the first six weeks recorded, and after that they relate, first to five sets of data, and then to three sets. The succeeding 8-hour shift values relate to six sets of

data, but it is to be remembered that they follow immediately on a 6-hour shift period which varied in duration from 6 weeks to 75 weeks.

The results are plotted out in the figure shown below, the dotted lines drawn through the curves representing the average values recorded in Table I. It will be seen that the output kept fairly steady

OUTPUT OF TINPLATE MILLMEN

during the initial 8-hour period, but on changing to 6-hour shifts, showed no response in the first week. Then it rose rapidly, and reached a maximum in the eighth or tenth week. In subsequent weeks it was somewhat irregular, but from the 8th to 19th weeks it averaged 111.4, as compared with a value of 100.2 in the 8-hour period.

4. *Fatigue Factors Measured by Variability*

J. D. WEINLAND, "Variability of Performance in the Curve of Work," *Archives of Psychology*, 87:5-6, 66-67 (Columbia University, 1927)

The muscular work with which this report deals consists of: (1) lifting a 10-pound weight with the second finger in the standard Mosso ergograph; (2) lifting a 25-pound weight with a gripping motion of the hand similar to squeezing a dynamometer; (3) squeezing the Smedley Dynamometer; (4) lifting a weight of 12, 18, 24, 30 pounds by contracting the muscles of the upper arm and bending the arm at the elbow in a device adapted from the regular gymnasium chest weights; (5) lifting a 30-pound weight attached to the foot by bending the leg at the knee and drawing it toward the body; (6) lifting an 80-pound weight with a kind of

rowing motion with the body in a sitting position, involving practically all the muscles of the body.

Ten subjects took part in the experiment and carried out a daily program of work for a period of about 6 months. Each subject passed through a training period on each machine and then entered upon a schedule of work which was planned so as to control conditions as far as feasible and to make possible a number of comparisons of specific data.

Each period consisted of: (1) A series of rhythmical muscular contractions, or lifts of the weight, lasting until exhaustion. The rhythm of these contractions was controlled by a metronome beating at 1-, 2-, or 3-second rate, except in a few cases where, with the metronome silent, the subject was allowed to choose his own rhythm. (2) A rest period was allowed of 5, 10, or 20 minutes. (3) Another series of muscular contractions followed similar to those before rest.

All work was graphically recorded upon a kymograph, so that each work period described above yielded a work curve, showing the height and number of individual muscular contractions and a record of the time signals produced by the metronome. The subjects were instructed to do their best at all times and to continue lifting the weight as long as possible. They were paid at a generous rate per hour and coöperated heartily in the experiment.

The height of each contraction in the work curve was measured with a millimeter rule, and the number of contractions counted. From these measurements the computations embraced in this report are derived. From the above brief description it will be clear that during each "work period" two "work curves" were made, the second curve following the first one after an intermission or rest period. . . .

Results and Conclusions.—1. Relative variability of output increases with fatigue. This is found true for total variability which includes the fall in the curve; it is found true for incidental variations; relative variability of several curves from an average curve is found to increase constantly with fatigue.

2. Variability of performance in beginning work can be affected by any one of a number of causes: the fact of having done previous work, the length of the ensuing rest period, the rhythm of work, the load, etc. It seems possible that variability might be made a measure of the effect of any one of these factors, by keeping all the others constant.

3. The variability curve for output in any one period is determined somewhat by the weight pulled. The deviations of several

curves at different points in those curves are very definitely affected by the weights pulled.

4. Individual differences in variability are both striking and important. These are found in comparing different parts of the individual work curves, and in comparing different work periods.

5. Individual differences appear to be greatest at the low output end of the work curve.

6. The increase of variability with fatigue is due rather to a loss of control than directly to the exhaustion of muscle.

7. Deviations among several work curves at different points in those curves are greater toward the low output end of the curves, but less again near the exhaustion point.

8. Difficulty in keeping time to a metronome increases with continued work. The tendency is to lose time.

9. The amount of time expended on work in the individual strokes is proportional to the amount of work done as measured by length of stroke. As work goes on the subject spends less time in working even though keeping time to a metronome; his rest each second is longer, his stroke "smaller" in every respect.

10. The contraction time of individual strokes is less than the relaxation time.

11. Subjects do not always learn, with practice, to work in the most efficient way. This may be due to (a) a closer following of directions, such as those given in this experiment, that lead to more intensive but less efficient work; or (b) a gradual adjustment to a more congenial effort.

12. If the date for finishing the experiment is known to the subjects they tend to do more work in the last few work-spells than in the preceding ones.

13. The degree of variability within the work curve appears to remain comparatively constant for a given individual, under particular working conditions.

5. *Mental Protection against Fatigue*

WHITING WILLIAMS, *What's on the Worker's Mind?*, 20-22, 28-30 (Scribner, 1920)

The men, of course, get to feeling that their work is never done. They have not the slightest interest in what it means or how it affects the operations of the mill around them because, I will say, nobody tries very hard to give it to them. It is all just a matter of doing as little work as the boss will allow.

Last week I tried to get the good notice of the different overseers by sticking close to my knitting. The bunch, of course, discouraged

it—"What the hell! Lotsa time"—and the bosses noticed me only when, after a long turn of work, I rested a moment. Their notice was the usual "Hey, dere! What da hell! Do you t'ink dis sleeping place?"

Not always is this query put in a mean way. But it simply expresses complete lack of effort to secure interest or to give instruction. The only thing in the world these "boys" have to give, or are asked to give, is their physical strength. They are hardly to be blamed if they try to guard their only capital by as many breathing-spells and as slow motions as the boss will stand for.

We laborers spend most of our time down-stairs around the checker-chambers beneath the furnace floor. Lately I summoned my courage and butted into what I supposed was a company restaurant, but which I now find is run by a group of open-hearth men. They are not listless like the workers down-stairs; they're very husky and seem trained down to the bone. But even the cattle-boat fo'c'sle never furnished such profanity. As they eat, their language is a goulash of blasphemy, obscenity, and filth. Of course, it's mostly in fun and for show. But even at that I would not have believed it possible of "bums"—and these are mostly Americans earning around ten to fifteen dollars a day.

Of course, every man working down in the hot and sooty checker-chambers with a boss's eye everlastingly on him, dreams to become a helper on the "floor" up-stairs, where a man is a part of a crowd which gets paid according to the tonnage of good metal it gets out of the furnace—and paid well. But if he can't be up there on the floor with him, the checker-brick tosser can at least begin to talk and think and swear like him—so, what the hell!

Any attempt to abate this line of talk should be based on the understanding of it. I am sure it has two causes. First, it is a sort of psychological "protective behavior." It is the mind's way of saying: "The only way I can accommodate myself to this fatigue is by not caring—by not taking it seriously." By the same token it is a way of pouring pep into yourself by putting, as it were, a whip into your language—by steam-heating your talk. It makes your words, in a short-sighted sort of way, more galvanic on yourself, and presumably on others, and so makes a short cut to the maximum effect of your breath on yourself and others which ordinarily can be secured, or at least aimed at, by the appeal of logic or good-will—these last being impossible because of fatigue.

Then, second: Some one having started the ball rolling because he was tired and needed either the protection or the stimulus of super-heated language, standards are created for a sort of God-and-man-insulting upstandingness which requires everybody else to

measure up by going him one better. The trouble is that, like the dope fiend, who gets no "kick" at all from what was once a huge dose, these "helper" chaos now have a hard time finding any emphatic way to express themselves. What can a man do when the most ordinary and inoffensive chair or tea-cup or sandwich is condemned to the uttermost, and when you call your best friend flippantly a triple or quadruple compound of the foulest and loathsomest possible conceptions—what can a fellow do when he really wants to use strong language?

As it looks now, the whole thing seems a combination of hard-working, husky humans trying to lessen the friction of circumstance by throwing out a sort of oil film of "I don't care," and then trying to hold their own in association with each other in meeting the husky demands of their husky jobs. . . .

As in the labor gang the outstanding feature of millwrighting is the long hours:

Sunday double turn (every other week)......	24 hrs.
5 nights at 13 hours..........................	65 hrs.
Saturday night	15 hrs.
	104 hrs.

Night-turn week you do nothing but work and eat and sleep—and not too much of the last two, either. You have a half-hour each night for your dinner—meaning, by the way, three more, or 107 hours under the plant roof. And you are pretty tired for a heavy breakfast. Unless you cut down your sleep, you have a short time for supper at four-forty-five or five before going to work again. By saving part of my "midnight supper" for a morning snack, I cut out breakfast, got into a bath-tub at seven-ten, and then into bed at seven-thirty for sleep until three-thirty or four, with only a few minutes for letters or papers before putting on working clothes again. I'm told that ordinarily millwrights get more sleep "on turn" than our tar-guns gave us—though we did get some.

With nothing but sleep in between the various nights, one turn seemed only the continuation of another, and the whole week felt like one continuous performance.

In talking with the open-hearth floorworkers I found they felt the same way about their fourteen-hour night-turn.

"This week just don't count—a man ain't no good to nobody, including himself, and how the nights of the day-run week do go by before you get around to enjoyin' 'em," said one first helper.

"It's bearable," said another, "when you can really catch your sleep. But when the flu was here, 'twas awful! Nearly all of us

had to wait on sick families—if we didn't have it ourselves—and for weeks we just went without sleep, seemed like, unless we could catch some around here on turn; and that was hard because, of course, every shift was short-handed."

I know now that such a worker simply doesn't have time to study or to grow or to learn English, or to keep a live eye on anything. I am constantly surer that one result of it all is that "what-the-hell" attitude—a man has got to take on the self-protection of the callousness which profanity represents or else get out of the long-hour end of the business.

Another result of eight working-days, one week and six the next, year in and year out, is I'm sure, the local and highly familiar celebrity known as the "whiskey-beer." After every shift the saloon at the corner has its customers lined up three deep and fully one-half take a "large small" glass of whiskey followed by a big beer. They down it quickly and walk away straight for home without the slightest joviality. But all say one or two of these "shots" helps them get a good day's sleep.

Frequent discussion is given to which saloon serves the best and biggest whiskey. Otto, who has millwrighted here for nearly thirty years, has worked his fourteen-turn fortnights with only two days off in two years. That's every day except two—Sundays and holidays not excepted. He—with others—says you've "got to be blamed careful about getting lay-offs or they'll tell you there's others at the gate that wants your job more'n you do." He seems to believe one whiskey-beer pretty regular stuff for him, and that, if particularly tired three can be carried without discomfort or loss of decorum. Four requires hurrying home and to bed to avoid trouble.

"Five or six whiskey-beers, yes, all right. Fifteen?—too much," a Slavic laborer argued yesterday quite seriously.

The heaters and other regular steel-workers tell of wanting everything to have a "kick" in it:

"Why, I remember last summer I had to do something for a good time, and damn me if I didn't go off for a trip to Cleveland and spend $100.00 in three days!"

I know how they feel. If you're tired and are going to meet the financial loss of laying off for a day or two, you don't want just ordinary amusements. You want something with a punch; you want something to jar you and give you a real sensation. An ordinary show or movie is too tame. I'll gamble that the eight-hour shift will bring an improvement in the local burlesque show!

B. Influences of Rest Pauses on Production

6. *Testing the Value of Pauses*

REX KNIGHT, "Work and Rest," *Industrial Psychology*, edited by C. S. Meyer, 77, 79 (Thornton Butterworth, Ltd., London, 1929); reprinted in U. S. by permission of Henry Holt & Co.

The rest pause should be introduced at about the time when the output has just reached its maximum. Working activity is then about to decrease; and the pause, by warding off fatigue and other detrimental influences, will tend to maintain output at a high level. For experimental purposes it will be best if only some of the workers are given the pause. Their work curve can then be compared with that of the other workers who have no "official" rest. If all the workers are given a pause at once, the subsequent data may be influenced in an unknown degree by accidental factors (such as alterations in equipment, in material or in other working conditions, or even by an influenza epidemic) as well as by the provision of the rest. Thus the results of the pause will escape exact measurement.

The workers should therefore be divided into two groups of approximately equal ability; and one group should be given a pause while the other is temporarily treated as a "control" group. (To ensure that the two groups will be about equal in proficiency, the workers may be ranked and then allotted alternately to the first group and the second.) Conditions apart from the rest pause will thus be the same for both groups. It will be necessary, however, to keep the groups apart; otherwise those workers who have been given a rest may tend to regulate their output by unconscious imitation of the others. If the work curve of the group of workers who have been allowed a rest is then of more satisfactory shape, it may be inferred that fatigue has been reduced.

The length of rest pauses, no less than their position in the work spell, requires scientific investigation. The most favourable pause will reduce fatigue, boredom and other detrimental factors while at the same time preserving the "warming-up" effect (known as incitement), interest and other beneficial influences. Too long a pause, while reducing fatigue, may dissipate incitement; too short a pause, while preserving incitement, may insufficiently reduce fatigue. It would seem that the rate of restoration of working capacity is greatest in the early stages of the pause and progressively decreases as the rest proceeds. In certain kinds of mental work, rests of 2 minutes after 40 minutes' work in a spell of 1 hour, and of 5 minutes after 80 minutes' work in a spell of 2

hours, were found to be more favourable than longer or shorter pauses. The results of many other experiments support the conclusion that the value of a rest is not proportionate to its length.

7. *The Gains of Rest*

R. B. Hersey, "Rests—Authorized and Unauthorized," *Journal of Personnel Research,* 4:42-43 (1925); reprinted by permission of Williams & Wilkins Co.

The various points brought out by investigation in both plants seem to suggest that rest is best achieved by *complete* relaxation. To accomplish this purpose in the factory it must:

1. Relieve the workers as individuals or as a group from
   A. Tension
      (*a*) Physical tension
      (*b*) Mental tension
      (*c*) Both physical and mental tension
      (*d*) Physical tension and subnormal mental tension, i.e., dispersed thinking
   B. All forms of restraint
2. Allow full opportunity for a restoration of physical and mental balance.

If we compare the effect of unauthorized resting or time stealing with this psychological norm, we can readily see that it almost entirely fails to satisfy the requirements. A complete relaxation of physical or mental tension is impossible, if the worker must remain near his machine in an attitude of work or has to steal away to a toilet. Under such conditions, the worker suffering from dispersed thinking is certainly very imperfectly removed from the dominance of his reveries, especially if they be unhappy. For the restraint of his machine or work is substituted the restraint of watching for the foreman. Certainly any sort of authorized rest or even rotation of jobs is better than this deleterious time stealing.

Any firm which decides to introduce rests of any sort is interested in seeing to it that their workers utilize the time given to the best advantage, both of themselves and of the firm. At present most firms giving rests allow the workers to spend the time as they see fit, seeming to act on the unwarranted premise that the workers will vary the recreation in a manner best suited to the need of both individual and occasion. From observation of the workers' actions one gains the impression that the older they are, the more they incline to complete quiet; the younger they are, the more they incline to conversation or dancing or athletics of

some sort. Moreover, the more physical fatigue enters, the more the workers tend to seek complete muscular relaxation, while purely monotonous labor or sedentary office work induces a desire for change of position or brisk movement. Certainly all these possible methods of resting give some relief from tension and restraint and are beneficial, but they fail to aim at complete relaxation. They do not bring the individual's greatest restorative powers into action. This purpose can only be accomplished by a condition approximating sleep, which is the most complete relaxation possible.

As regards muscular fatigue, few objections to this proposition will be raised. When the problem is one of reducing the effects of mental strain or monotony, the case is not so clear. Yet experience in psychopathological clinics has proved that both mental strain and obsessive reveries are relieved and checked most effectively by the induction in the patient of complete muscular relaxation. Such relaxation is but a preparatory measure to the induction of sleep.

8. *Regularity of Spontaneous Rests*

H. M. VERNON, T. BEDFORD and C. G. WARNER, *Rest Pauses in Heavy and Moderately Heavy Industrial Work*, Report No. 41 of the Industrial Fatigue Research Board, 20-21 (His Majesty's Stationery Office, London, 1927)

Men engaged (at a day rate) on work of a moderately heavy character such as road making, agriculture, and dock labouring, have been found to take rest pauses from work amounting to about 11 minutes per hour. If the work is of a regular character, the men spontaneously take rests with considerable regularity, usually at about six-minute intervals; but with more varied work the rests become more and more irregular in frequency and duration.

Piece-rate workers employed on work requiring a similar degree of physical energy probably take shorter rests than day-rate workers, but even in them the rests are frequent. The more arduous the work the longer the rests, and in the heavy work of pitch loading they amount to 22-26 minutes per hour, and in rolling tinplates to from 14-28 minutes per hour. The men take similar amounts of rest throughout the working day.

Colliers take rests varying from 7 to 22 minutes per hour, according to the atmospheric conditions under which they are working. From 5 to 9 minutes of this time is voluntary, each voluntary rest taken usually being of less than a minute in duration. The involuntary rests (generally due to lack of tubs) are only a ninth as numerous as the voluntary, but they last three times longer.

It is calculated that they have only a fifth the value of voluntary rests in relieving fatigue.

The colliers take rests with extreme irregularity, owing to the very varied nature of their work. It would be quite impracticable to devise an artificial scheme of rest pauses for them.

9. *Determining Rest Periods*

G. H. SHEPARD, "Effect of Rest Periods on Production," *Personnel Journal*, 7:186 (1928); reprinted by permission of Williams & Wilkins Co.

The effect of rest periods on fatigue in light-heavy muscular work was tested in the laboratory by having students work at a gymnasium chest-weight machine under controlled conditions.

The results indicate that a worker on light-heavy muscular work and on an eight-hour day, cannot give his maximum output unless he rests at least 16.66 per cent of the time during working hours.

There were some indications that it is best to increase the proportionate sizes of rest periods as the day advances and fatigue accumulates.

The subjects of this study, who were students and of superior intelligence, were able, after a little instruction and experience, to select work and rest periods for themselves almost as well as anyone who made tests on them.

10. *Pessimistic Revery as a Symptom of Fatigue*

ELTON MAYO, "Revery and Industrial Fatigue," *Journal of Personnel Research*, 3:274-278 (1924); reprinted by permission of Williams & Wilkins Co.

The evidence we gathered was obtained at first by observation and by conversation directed to reveal the nature of the reveries that accompanied work. By this means we speedily discovered that almost every worker suffered from foot-trouble for which he apparently knew no effective remedy. Many also laid claim to neuritis in various localities of arm, shoulder and legs. In addition to this, we discovered that their reveries were apparently monotonously and uniformly pessimistic. Occasionally a worker would flare out into apparently unreasonable anger and incontinently leave his job. Their own opinion of their work was low. "You need strong legs and no brain for this work." "Piecers get disgusted, they are always getting disgusted."

Rest Periods Introduced.—After some discussion of the evidence and the situation, the management agreed to institute two or three ten-minute rest-periods in the morning and again in the afternoon. In these periods, the workers were to be permitted to lie down; we

undertook to instruct them in the best method of muscular relaxation. By this means, we hoped to remedy, at least in part, the postural fatigue they suffered and also to interrupt and, if only temporarily, dispel the pessimistic revery.

We began with one team of piecers, about one-third of the total number, and the results were interesting from the first. The men themselves were pleased and interested; they speedily adopted the method of rest we advised. The effect was immediate—symptoms of melancholy preoccupation disappeared, the labor turnover ceased, production was maintained, the morale generally improved. It became evident that such marked effects could not be attributed to the mere elimination of physical fatigue. In the first place, the effect showed itself immediately whereas, according to investigators such as C. S. Myers and H. M. Vernon, the relief of physical fatigue is not expected to show for possibly two months. In the second place, the improvement of morale seemed to include workers not upon the team. In October of last year, the management, pleased with the improved condition of the men, decided to extend the rest-period system to include the entire personnel of the spinning department. This made it possible for us to do what we could not do before—to measure the effect of the rest-period upon the productivity of the department. Until October, 1923, the spinning department had never earned a bonus; in October and every month since, with one interesting exception, the spinners have made a bonus addition to their wages. . . .

Effect on Output and Turnover.—The period from October, 1923, to January, 1924, demands no lengthy comment. The mental and physical condition of the men continued to improve and whereas the financial incentive of the bonus had not operated to stimulate production while they were fatigued, they now began to be pleased by the fact that they were earning bonuses as never before, and yet simultaneously feeling less fatigued. The system was not, however, altogether satisfactory. It had occurred to some one in the factory (not an executive officer) that the rest-period idea might be improved. The men were accordingly made to "earn" their rest-periods; that is, they did not necessarily get a rest at a set time, they were allowed to rest only after completing a certain operation. This meant that they could not expect a definite number of rests at stated periods. On some days, they had two rest-periods only. For the most part, they had three or four in the day and the innovation worked fairly well.

This general condition continued until Friday, February 15, when in response to a heavy demand for goods, the rest-period system was abandoned. For a week, the department continued to

work without rests and on the following Friday, February 22, I found that the old pessimistic reveries had returned in full force accompanied by some of the former symptoms of fatigue. I immediately appealed to the executive officer in charge and he ordered the resumption of the rest-periods on Monday, February 25. I had at the time no knowledge of the sharp fall in productive efficiency that was taking place. I had based my action entirely on the symptomatic revery I had come to know. On Monday and through March, the rest-periods were resumed, but the old unsatisfactory method of requiring the men to earn their rest-periods was employed. The consequence was that in March, the incidence of rest-periods was highly uncertain and irregular. On a given day, certain men might have no rests at all, others would have one, two, three, or rarely four. In spite of this, the productive capacity of the department shows in the chart, a distinct tendency to improvement in the latter part of March—a tendency which I attribute to diminished physical fatigue rather than to mental causes.

At the end of March, the president of the concern summoned a conference to discuss the cause of the remarkable diminution from 80 to 70 per cent in respect to productive efficiency. We were able to point out that in March there had been a recrudescence of absenteeism, an ill which had notably diminished in the October to February period. This recrudescence meant that the men were taking their rest-periods in the form of "missed" days, a proceeding which did not greatly remedy their fatigue and which produced chaos in the factory. We put it therefore that the question was not whether a certain proportion of their working time was to be given up to rest. We were asking in effect that a less proportion should be thus allotted, but that it should be done systematically. In addition to this we were able to claim that the whole rest-period system had never had a fair trial. In other words, it had not been possible for a worker to know as he entered the factory in the morning that he was assured of a definite number of rest-periods in the day.

At this stage in the discussion, the president decided upon a somewhat heroic experiment. He ordered that during the month of April, the spinning-mules should be shut down for ten minutes at a time four times per day and that all hands from the foremen down should lie down and rest as they had been instructed to do. There was some difficulty in securing the requisite amount of floor-space for approximately forty men to lie down by their machines and in securing sufficient sacking to provide for their comfort. With the exception of the president himself, there were few who believed that this drastic alteration of method would result in in-

creased production. The men themselves believed that the forty minutes lost by forty men per day could not be recovered. They pointed out that their machines could not be speeded up and that "there was no other way of recovering the lost time." In spite of this, the returns for April showed an improvement on March. The March figure had been 70 per cent, the April figure was 77½. This, while it represented a 7½ per cent gain in the company's rating, was actually a 10 per cent improvement. The men had had their rests, the pessimistic revery had again disappeared; simultaneously their morale had much improved, and they had earned a two and a half per cent bonus. In the month of May and thereafter, the president ordered a return to the system of alternating rest-periods, with this difference, that each group of three men in an alley was to determine for itself the method of alternation, the understanding being that every worker was to have at least four such periods daily. In the month of May, the average efficiency of man-hour production was 80¼ per cent. In June, it reached the then record high figure of 85 per cent.

QUESTIONS

1. How would you set up a critical experimental check of the alleged beneficial effects of rest pauses?
2. Summarize the major mental and physical consequences of fatigue. Give the evidence for each assertion.
3. What is the difference between genuine fatigue and sensations or "feelings" of fatigue? What is the remedy for each?
4. What other terms are commonly applied to "pessimistic reveries"?

CHAPTER XII

THE WORKING ENVIRONMENT

Man does not labor in a vacuum. His mind is in constant reciprocal relation with the environment. Some of these environmental features facilitate performance and some inhibit it. A primary objective of an efficiency program would be to elevate the favorable factors to a maximum and reduce the unfavorable ones to a minimum.

The undesirable elements in the ordinary plant can be quickly identified because of their obtrusive nature. Lighting which is too strong is as bad as feeble light. Optimal illuminating conditions must be determined specifically for each building and room, giving due regard to such variables as the nature of the work, time of the day, source of illumination, design of the interior, etc.

Ventilation is a difficult thing to regulate, but the workers' comfort and output can be tremendously enhanced by attention to this factor alone. An obstacle to progress in this direction is the persistence of the antiquated chemical theory of "bad air;" the truer physical theory of ventilation will modify practice in the right direction. Air movement rather than proportion of carbon dioxide seems to be the critical element in good ventilation. As in the case of light, optimal ventilating conditions depend upon the normal temperature and humidity of the workshop, the amount of physical effort involved, the presence of odors, etc. Strenuous bodily work, e.g., requires lower temperatures than sedentary occupations.

Much of industrial noise is unnecessary. A little ingenuity has reduced the rattle of most engines to a steady purr; there is no reason why more careful lubrication and the installation of shock-absorbing floor bases could not also eliminate most of the vibration which is even more damaging than sheer noise. It must be admitted that man possesses a remarkable capacity for adjusting to sound stimuli, so that after a period of exposure they are disregarded. In fact, some laboratory studies suggest

that a certain amount of noise possesses a dynamogenic effect, i.e., actually heightens performance. However, it is known that such dynamogenesis takes place at the price of greater expenditure of energy, and that in the long run the drain upon the organism will be excessive.

Improvement of work conditions not only effects output directly but also indirectly through the beneficial influence upon morale. The urge to work is modified by many apparently minor items such as clean surroundings, pure water, sanitary toilet facilities, etc. There is nothing "paternalistic" in these provisions, and where such a term is applied it generally indicates an unwillingness to do what ought to be done. Paternalism is unwarranted interference in a man's private affairs or doing for him what he can do just as well for himself, such as selecting a bride; but it is not paternalism when management aids its employees to obtain benefits which they could hardly secure alone, such as social insurance in its various forms.

1. *Objectionable Working Conditions*

HENRI DE MAN, ***Joy in Work***, **translated from the German by Cedar and Eden Paul, 157-159 (Holt, 1929)**

The following demand special mention as conditions in the material environment of the worker at his occupation which may be among the causes of distaste for work:

(*a*) Unhygienic workshop conditions (bad air, too high or too low a temperature, excessive dampness of the atmosphere, defective ventilation, dust, evil-smelling raw materials, etc.)

(*b*) Bad hygienic conditions outside the workshop proper (insufficient or unsavory lavatory accommodation, lack of proper cloakrooms and washing appliances, etc.).

(*c*) Dangers attendant on the occupation.

(*d*) Excessive noise from machines or other working appliances.

(*e*) Poor light.

(*f*) Lack of cleanliness in the workshop.

(*g*) The depressing influence of an ugly and uncongenial environment. This may concern either the inside of the workshop, or its outside, or both. Among such influences must be counted the degrading symbolism of identifying the workers by numbers, the prison-like aspects of many factories and factory gates, the beginning and the ending of work to the sound of the factory whistle, etc. (In Levenstein's *Arbeiterfrage,* page 133, a Berlinese

plush weaver is reported as saying: "I am whistled to and from my work, as the boss whistles to his dog.")

These causes are so familiar that it would be superfluous to illustrate them by specific examples drawn from the reports. It is worthy of note that in most instances a remedy could be found that would not entail serious technical or economic difficulties. Of course we must not overlook the fact that often enough the workers have been so much demoralised by the "occupational complex," have been so much disheartened by the unconscientiousness, niggardliness, and slovenliness of bad employers, as to give some justification for employers' refusal to improve matters on the grounds that the workers would not heartily coöperate. This vicious circle must be broken by initiative from the workers' side as well as from the employers. In such cases the first step may be decisive. The courage for such a step would be commoner if it were not that the workers are held back as a rule by the feeling that they have no personal interest in output, and the employers by their unacknowledged dread of admitting the existence of guilt.

A. Illumination and Vision

2. *Characteristics of Vision and Illumination*

A. T. Poffenberger, *Applied Psychology,* 188-191 (Appleton, 1927)

The most effectual lighting methods are conditioned by certain characteristics of the visual mechanism, which are innate and consequently common to all human beings. A description of these characteristics will clear the way for a discussion of illumination problems. First among these conditions is the instinctive tendency to turn the eyes toward bright objects in the field of vision, so that the light shall cast an image upon the center of vision, which is the region of clearest vision upon the retina. This turning of the eyes is synonymous with visual attention; it appears soon after birth and is one of the first signs of the infant's attention to its surroundings and its discrimination of objects. Not only does it appear early, but it is never completely outgrown. The actual movements may be inhibited, not, however, by a failure of the muscles to contract, but as a result of the voluntary contraction of antagonistic muscles. Any attempt, then, to prevent this instinctive act of attention, if it succeeds at all, requires extra muscular effort voluntarily controlled, and consumes energy.

The second important characteristic of the visual mechanism is the nature of the sensitivity of the retina to light. The main point to be noted in this connection is that the retina differs considerably

in sensitivity in its different parts. It is commonly supposed that, because one can see most distinctly when looking directly at any object, the part of the retina thus concerned, the so-called center of vision, is also the most sensitive. This, however, is not the case, for the region around the central one is much more sensitive to light intensity. The difference may be best described by saying that the peripheral parts of the retina are always adjusted for dim or weak lights, while the center of the retina is always adjusted for bright lights. So true is this that the center of vision with which one sees best in bright lights is practically blind in dim light, while the peripheral parts are used for vision in its stead. This rather striking fact may escape our observation yet a very simple experiment will at least give an indication of it. If one watches for the stars to appear as darkness descends in the evening, he is surprised to discover them first out of "the tail of his eye"—that is, he sees them first in indirect vision, or with the sensitive peripheral region of his retina. What are the consequences of this adjustment of the peripheral retina for very weak lights? Every one knows the unpleasant effects experienced upon coming from darkness into very bright light, a temporary blindness, or if not that, an uncomfortable glare which rather quickly disappears. Now the peripheral portions of the retina are always in this relatively sensitive state, comparable to that of the central portion of the retina after fifteen minutes in darkness. Bright lights falling upon the eyes from the side produce an uncomfortable glare.

A third characteristic of the eye is the tendency of the accommodation mechanism always to adjust itself so as to see clearly or focus properly upon the object which is being looked at or attended to. So, just as there is a tendency to turn the eyes toward a bright object in the visual field, so is there a tendency to focus upon it in order to see it clearly. This is either an instinctive reaction or it is acquired extremely early in life, and is almost impossible to overcome, as any one knows who has tried to learn to fixate a given near object while attempting to pay attention to another more distant object. There is thus a constant conflict between the tendency to accommodate for the object of involuntary attention and the object voluntarily looked at.

A fourth characteristic is the contrast effect produced when neighboring parts of the retina are stimulated with lights of different intensities or colors. For instance, when a dark and a light object are viewed side by side, the white looks whiter and the black looks blacker than if seen alone. In a word, the contrast effect is always in the direction of the greatest opposites, a white object inducing a black by contrast, etc. This phenomenon is especially

pronounced upon the peripheral parts of the retina, hence a bright object seen in an otherwise dark field has its brightness enhanced and as a result of this an uncomfortable glare is produced.

From a consideration of these four characteristics of vision, we can derive one of the most fundamental and yet one of the most often violated laws of illumination, namely, that *the whole visual field should be as nearly uniformly lighted as possible.* If a person is reading in a room with a ceiling light and unscreened side lights along the walls, each one of the latter forms a bright image or a glare spot upon the sensitive peripheral part of the retina. Contrast effect with the darker background tends to make this image appear even brighter than it is. This stimulation arouses the reflex tendency to turn the eyes toward the light source, and at the same time the tendency to change the accommodation of the eye from a near point to a far point. One of three effects will be produced: the reflex responses will occur, with the consequent distraction of the attention from the book; or they will be inhibited as a result of the contraction of antagonistic muscles, at the expense of considerable strain and effort; or there will be a continual fluctuation in direction of the eyes and their accommodation from the book to the distracting light. This muscular strain will produce pain in the eyes and head, nervousness and general fatigue, in addition to the discomfort due directly to the glare.

It is largely the value of uniformity of illumination which makes natural lighting, or daylight, more efficient than artificial lighting, because with the former an even distribution of light is more likely to be attained without intention. Even here, however, there may be a lack of uniform distribution. Wrong location of the windows and skylights, incorrect color of wall coverings and window shades and the presence of polished surfaces from which the light may be reflected may serve to weaken the advantages of natural light. Most of these faults may be corrected by simple means, such as the use of ground glass in windows, removal of polished objects or giving them a dull finish, and painting the walls a soft yellow or gray. For instance, if the walls are very dark, as with blackboards in schoolrooms, there is so much difference in the intensity of the direct light from the windows and the reflected light from the walls, that the uniformity of distribution of light is destroyed, and the evil glare effects of contrasting surfaces appear. The polished nickel trimmings of a typewriter or its glossy white keys are sufficient to add much to the strain and fatigue of a few hours' work.

It is with artificial lighting that the most flagrant disregard of this rule of even distribution occurs. In lighting from exposed sources it is not unusual to find the brightest surface from 1,000,-

000 to 2,500,000 times as brilliant as the darkest; and from 300,000 to 600,000 times as brilliant as the reading-page. These extremes of brightness in the field of vision are, tests show, damaging to the eye.

3. *The Factors in Lighting and Their Effect on the Efficiency of the Eye*

C. E. Ferree and G. Rand, "The Ocular Principles in Lighting," *Transactions of the Illuminating Engineering Society*, 20:273-288 (1925)

Perhaps an analysis of the act of seeing would be helpful. Two groups of functions are involved: the resolving power of the refracting media or the power to form clear images on the retina; and the resolving power of the retina or the power to discriminate detail in the images formed. The resolving power of the retina may be further subdivided into three functions: the power to sense colorless light, brightness sensitivity; the power to sense colored light, color sensitivity; and the power to discriminate separateness of detail or what is commonly called space discrimination. The explanation of the serviceability of light and of its elaboration into a satisfactory system or plan of illumination is to be found in terms of the effect on these functions and their interactions, both momentary and through a period of time. For example, wave length, intensity, composition of light and purity affect the resolving power of the refracting media or the power to form clear images on the retina; intensity, brightness or luminosity, hue and saturation, the power to discriminate detail in the image formed or the resolving power of the retina; and evenness of illumination, evenness of surface brightness, diffuseness of light, and angle at which the light falls on the work, an interaction between these groups of functions.

Wave-length of light affects the clearness of imaging through diffraction. Because of this phenomenon faint rings of light form about each point in the image. These rings known as diffraction rings or circles, overlapping neighboring points, serve to blur the image. Their breadth varies directly as the wave-length of light and inversely as the aperture of lens used, determined by the breadth of the pupil. From this it follows that clearness of imaging varies inversely as the wave-length used and that the lens should have its highest resolving or focussing power for a short wave-length. For example, it is well known that in microscopy the highest power to discriminate detail is given by the short wave-lengths and that in microphotography the sharpest images are formed on the photographic plate by these wave-lengths.

If then it is true that the eye sees most clearly when used in conjunction with the microscope under the short wave-lengths it might be inferred that an analogous result would be obtained when it sees its object by its own powers alone. This, however, has been found not to be true, at least for the seeing of black letters or other characters on the printed page illuminated by the wave-lengths in question. The clearest seeing, also the greatest speed, power to sustain, etc., are given by the wave-lengths in the mid-region of the spectrum,—the yellow, the orange-yellow and the greenish-yellow. Moreover, this result is not surprising when we consider the difference in the factors involved in the two cases. The short wave-lengths form the clearest images on the retina, but the wave-lengths in the mid-region of the spectrum give the retina its highest power to discriminate detail in these images. That is, in the visual field the image-forming function is involved only once; and the advantage of the short wave-lengths due to the diffraction effect is more than compensated for by the greater advantage given to the retina by the wave-lengths in the mid-region of the spectrum. In vision with the microscope, however, the image-forming function is involved twice, that is, another refracting system has been added to the eye and whatever affects this function favorably, becomes of correspondingly greater relative importance in the total act of seeing.

The relation of wave-length to lighting is obvious. None of our artificial illuminants are entirely colorless—all have a dominant wave-length or group of wave-lengths. Some even, the so-called filamentless illuminants, approximate spectrum lights in their simplicity or purity. Unfortunately, however, these illuminants do not radiate exclusively or dominantly the wave-lengths of the spectrum which have been found to give maximum acuity. Moreover, the hue of the illumination given is not the most favorable for the discrimination of the black letter on the printed page.

Purity of light affects the clearness of imaging through chromatic aberration. Aberration circles form about each point in the image due to the difference in the focal length of the lens for the different wave-lengths. Clearness of imaging which depends upon the number and breadth of these circles sustains a direct relation, therefore, to the number of wave-lengths making up the light in question and their displacement from each other in the spectrum.

The influence of *composition* of light is a combination of the effects of wave-length and purity; the shorter the wave-lengths and the greater the purity the clearer is the image formed. In drawing conclusions from this with regard to lighting, however, one must remember that clearness of imaging is only one of the functions

involved in clearness of seeing. The retinal powers and what are favorable to them must always be taken into account. One might be tempted, for example, to conclude from what has just been said of purity and composition that lights of the greatest purity, namely, spectrum lights and the illuminants which most closely approximate them in simplicity, give uniformly greater clearness of seeing than mixed lights. This is not true. Spectrum lights *do* give greater clearness of seeing than mixed colored lights of the same hue, saturation and luminosity; but white light, which is made up of all the wave-lengths of the spectrum mixed in what is called a balanced or neutral proportion for the eye, gives a better power to discriminate detail on the printed page than any colored light of equal luminosity even though of spectrum purity. As will be seen later, this is due to the fact that color forms an unfavorable background against which to discriminate details in black which more than balances the disadvantage of the slightly blurred image due to the mixed character of the white light.

Hue of color.—The effect of color on the power of discrimination should be discussed in relation to the type of detail that is to be discriminated. If the detail is a black letter or other printed character, hue of light determines the quality of background from which it must be distinguished. Some hues are apparently more favorable than others as a background for the discrimination of details in black. All hues are inferior to white in this regard. Repeated tests have shown that white is the best background on which to discriminate details in black.

Saturation may be defined as the proportion of the chromatic or colored to the achromatic or colorless component of the sensation aroused by the light. As the saturation is increased for any hue its inferiority in relation to white as a background on which to discriminate details in black is increased. The colors in the mid-region of the spectrum owe their superiority to other colors in this regard in part to their hue and in part to their low saturation. This point has been determined through a large number of tests on spectrum lights selected at eight significant points in the spectrum; mixed colored lights, spectrophotometered to give their composition; and the artificial illuminants: kerosene, gas and electric, including the various types of carbon and tungsten lamps and six Welsbach mantles differently colored by varying the proportion of ceria and thoria. In some cases the tests were made with the lights equalized in luminosity alone; and in others when equalized both in saturation and luminosity. The equalization in luminosity alone was made to duplicate the conditions in a lighting situation; the equalization in both saturation and luminosity to determine whether

both saturation and hue must be taken into account in listing the factors which affect the powers of the eye.

Intensity as a factor should be discussed in relation to kind of light. In case of white light the effect of increase of intensity is to increase its luminosity or brightness. This increase of luminosity gives a greater power for clear seeing independent of sharpness of imaging through its influence on the retina's power to discriminate detail in the image. There is an effect too on the sharpness of the image formed by the refracting system due to the contraction of the pupil. That is, the narrowing of the pupil excludes the aberration effects and other irregularities resulting from the use of the periphery of the lens and cornea and by narrowing the cone of light from each point in the object reduces the size of the diffusion circles formed by faulty focussing.

The following points may be noted with regard to the benefit of increase of intensity: (1) The benefit is greater when the work or details to be discriminated are small than when they are large. (2) It is greater for an eye that is defective in refraction than for the normal eye. (3) It is apparently greater for the old than for the young eye. These effects are not difficult to understand. The larger and clearer the image formed the less need has the retina of high intensities of light to enable it to discriminate detail and the less it benefits by increase of intensity of light; and, conversely, the smaller and more blurred the image is the more need is there for high intensities and the greater is the benefit from increase of intensity. It is a matter of common ophthalmic experience to find that an eye which is apparently well enough corrected for medium and high intensities of light is not well enough corrected for low intensities. Small defects and blurrings of the image that give no trouble at high illumination may give a great deal of trouble at low illumination. Unless there is some accompanying photophobia there is a general demand among glass wearers for more light. Particularly do they find a low speed in the use of the eye at low illuminations and diminished power to sustain clear seeing through a period of work.

Among the reasons why an old eye needs more light and should derive more benefit from an increase in the amount of light, the following four may be mentioned: the inferior imaging power of its refracting media; the diminished transparency of the media; the decay in all of its processes of adaptation and adjustment; and the failing powers of the retina itself. In this connection it may not be out of place to note also the danger of the prolonged mydriasis attendant upon low illumination to old eyes suffering from a predisposition towards glaucoma; likewise, the similar danger to

this type of eye from the inflammatory conditions which may be set up by the strain resulting from working or reading under an inadequate amount of light. In determining the amount of light needed for different people and for different conditions of working, all of these facts should be taken into account. And especially in case of all eyes should it be noted that the effect of intensity of light on the speed of seeing and the power to sustain clear seeing through a period of work is much greater than on acuity itself. The eye sees its object much more quickly, sustains its powers of clear seeing very much better, fatigues less quickly and suffers less discomfort under daylight intensities than under those found in artificial lighting by present practice. These facts have an important bearing on industrial lighting, particularly in those industries in which a high grade of performance is required of the eye. In such industries an increase of intensity of light should result in an increase in the ease and speed with which the employees do their work and a better power to sustain a given level of performance throughout the working period, provided that the increase of intensity is secured under the proper conditions of distribution. This latter, however, is an important qualification to add. If the increase of the intensity of the illumination is to be accomplished by a proportionate increase in the number and brilliancy of bright sources of light in the field of view or by an increase of glare on the working surface, the attempt will result in harm, not good. Twelve years ago we would not have considered it safe to speak in favor of increased intensities. Now owing to the great advancement that has been made in ways and means of delivering the light safely and effectively to the eye, we consider it not only safe but strongly advisable. The large difference in intensity between a room well lighted by daylight (10 to 20 foot-candles) and a room lighted by artificial light according to present standards of practice (5 foot-candles and more often less) is in our opinion no small factor in the difference in the eye's well-being and vigor and efficiency of performance in the two cases. The room well lighted by daylight gives us the best results for the eye that have as yet been obtained and we will not go far wrong in taking it as our pattern for artificial lighting with regard to intensity as well as for color and composition of light and the factors which come under the head of distribution.

In this connection too it may not be out of place to note the mentally stimulating effect of high intensities of illumination. All are familiar with the somnolent effect of low and the wakeful influence of high illumination. Many are not able to sleep at all in the full light of day. Personally, one of the writers is a poor night

worker. He was astonished at the curative effect on this very annoying disposition produced by more than doubling the intensity of illumination under which the work was done. Two reasons may be noted for the benefit: the relief from eye-strain produced by the higher intensity of light, and its generally stimulating, mentally awakening, consciousness-heightening influence. Again, however, the caution must be urged against the increase of intensity through the introduction of high brilliancies into the field of view or glare on the working surface. If these are involved a premature drowsiness and loss of mental alertness through eye fatigue are induced rather than warded off by the increase of intensity. . . .

More important, however, than any of the factors pertaining to the light itself, with the exception of intensity of light, are the distribution factors: evenness of illumination, evenness of surface brightness, diffuseness of light and the angle at which the light falls on the work. The desirability of evenness of illumination is too obvious to need much comment. That is, unevenness of illumination is not only poor economy of distribution, but when the differences are large in conjunction with differences in surface reflecting power they introduce glaring contrasts and harmful brilliancies into the field of view. Unevenness of illumination of the reading page or other working surface too leads to eye fatigue by causing the eye to see its objects unequally well as it travels over the page, which tends to induce changes in adjustment to rectify the deficiency. With the exception of changes in pupil size, these changes are maladjustments which work against, rather than for clear seeing, and tend to fatigue the eye. These ill-suited changes which take place automatically when the eye is trying to clear up its vision as the result of the conditions imposed by bad lighting will be discussed at a later point in the paper.

Diffuseness of light and the angle at which the light falls on the work are important as contributive factors in relation to the disturbance which is commonly called glare on the working surface. The other important contributive factor is the way in which that surface reflects the light that falls upon it. Surface reflections are of two kinds, specular and diffuse. Specular reflection occurs from surfaces which are polished or glazed; diffuse reflection from surfaces which are mat or rough. The relation of specular and diffuse reflection to the problem in hand may be summarized as follows: (1) Diffuse reflection alone is serviceable to vision. The eye sees its objects in the working plane only by light diffusely reflected from that plane. The light specularly reflected is either entirely wasted, not entering the eye at all, or worse than that, is directly harmful to vision. Which of these two results is obtained depends upon the

relation of the angle at which the surface receives the light and the angle at which it is viewed by the eye. When the difference between these two angles is great, the former result is obtained; when it is not so great, the latter, and in inverse relation to the magnitude of the difference. (2) The light diffusely reflected from the surface spreads from each point as it would were the surface itself a source of light and, when focussed, forms an image of the surface. With light specularly reflected, however, this is not the case. Only the direction of the beam as a whole is changed; the angle of spread or divergence of the component rays is not affected. When a beam of light so reflected is focussed an image is formed of the source, not of the reflecting surface. When viewing a surface from which both kinds of reflection occur, the eye focusses, therefore, for the diffuse, not the specular reflection. The result is an image of the surface overlaid and blurred by a partially focussed image of the source. (3) The disturbing effect of specular reflection reaches its maximum when the surface is illuminated by a direct beam of light and is viewed by the eye at the same or approximately the same angle as that at which the light falls on the surface. It is comparatively slight when this surface is illuminated by diffuse light and is, moreover, independent of the angle at which the surface is viewed.

From these considerations the relation of the harmful effect of specular reflection or glare to type of lighting system is obvious. If the light which falls on the surface is well diffused by one or more previous reflections and is evenly distributed, the confusion of vision from glare is slight. However, if it be received directly from the source, concentrated and perhaps wrongly directed by a reflector, the effect is very trying indeed. A common cause of specular reflection from the working surface is the glazing or sizing of paper. One of the important specifications of the ideal printed page is the amount of glaze allowable. Obviously this depends to a large extent on the type of lighting employed. A great deal of glaze may be permitted when the illumination is received from totally indirect and dense semi-indirect reflectors or from direct reflectors provided with a means of diffusing the lights. A much smaller amount becomes intolerable when used under the non-diffusing types of direct lighting units.

The most important hygienic factor, however, in artificial lighting as it is practised at the present time is *evenness of surface brightness* or its converse, *high brilliancies in the field of view.* Color and composition of light, evenness of illumination, etc., have been handled pretty satisfactorily so far as the general run of eyes is concerned, and higher intensities can be produced without a great

deal of difficulty. The commercially most important method of changing the color and composition of light, however, has been to raise the temperature of the radiating body used as source. Witness, for example, the color of light from the low temperature carbon lamp as compared with the high temperature, Mazda C, gas-filled lamp. These higher operating temperatures have increased enormously the surface brightness of the luminous filament and have rendered the need for protecting the eye from harmful brilliancies increasingly important. Among the detrimental effects of high brilliancies in the field of view the following may be noted:

(1) The brilliant image falling upon a part of the retina highly sensitized because of its accustomed exposure to low illumination causes a sharp contraction of the pupil. A reduction of the pupil breadth by one-half means a cut-down of 75 per cent in the amount of light entering the eye from the working surface. This in cases of artificial lighting, where the eye is already receiving too little light from the working surface, reduces enormously the ease, speed and power to sustain clear seeing of the details of that surface. That is, the effective light from a surface receiving 5 foot-candles would be cut down to 1.25 foot-candles by this reduction in the size of the pupil, and a surface receiving 3 foot-candles to 0.75 foot-candle. This we scarcely need point out has its effect on lighting bills as well as ophthalmic bills. Some idea of the magnitude of these exposures may be obtained from the following figures. In some of the lighting systems tested by us of a type now in common use, the highest brightness in the field of view, namely, the luminaire itself, ranged from 600,000 to 800,000 times that of the working surface when both were compared or photometered in central vision. Had the brightnesses been compared as the surfaces were actually seen in the lighting situation—the working surface by the central portion of the retina and the luminaire by the more highly sensitized periphery—the difference would have been still greater. The harmful effects of these surfaces in the field of view increase, of course, with the number. And not only does the influence of this factor cut down the light received from the working surface, but it greatly reduces the power to see details in that surface from other causes to be noted later. Obviously, the surface which should control the pupil's reaction to light if that reaction is to be of service to clear seeing is the working surface itself, not the source of light. These abnormal contractions of the pupil induced by brilliancies many thousand times greater than are ever found on any working surface are also extremely uncomfortable and irritating to the sensitive iris. They doubtless lead to unhealthy congestions in the network of blood-vessels on the front and back

surfaces of the ciliary body and the train of evils which may result therefrom, and to inflammations and congestions in other parts of the eye. I need scarcely point out that a hyperæmia of the conjunctiva soon takes place as the result of such an exposure due to this or some other harmful reaction within the eye. It is not altogether improbable too that a contraction of the pupil so largely in excess of the normal amount puts a strain on the muscles of accommodation because of the automatic tendency of the pupil reaction and accommodation to take place together in a more or less fixed relation.

(2) The presence of a bright source of light or other surface of high brilliancy in the field of view produces a blinding effect through a phenomenon known as irradiation; that is, the source seems to be surrounded by a broad and intense halo of light, the intensity of which falls off as the source is receded from. This serves to confuse and blur seeing in direct relation to the intensity of the source and in inverse relation to its distance from the line of sight and the brightness of the remainder of the field of vision. Two causes of this phenomenon may be noted: the scattering of light by the refracting media of the eye which serves to throw an overlay of unfocussed light on the image of the working surface; and an induction or spreading of the excitation on the retina which produces a similar overlay in sensation. The effect of both of these factors on the clear seeing of details in black on a white surface is very similar to that produced by laying a coat of white paint over a white surface on which black letters or other characters are represented. The white or luminous overlay affects the black more than the white and the power to discriminate the black letters from the background grows less with an increase in the density of the overlay.

(3) The presence of high brilliancies in the field of view produces disturbances in the control of the mechanism of the adjustment of the eye which rapidly lead to the fatiguing of the muscles of adjustment and the loss of power to sustain the precision of adjustment needed for clear seeing. The most favorable conditions of illumination for maintaining easy and comfortable fixation and convergence through a period of time, compatible with other conditions of clear seeing, are to have the field of view uniformly illuminated with diffuse light with no extremes of surface brilliancy. The illumination of the retina then falls off more or less uniformly from center to periphery and the brightest image formed is that of the working surface. The image of the working surface then controls reflexly the adjustments needed for seeing details in that surface without opposition from brighter images. On the contrary,

the presence of high brilliances in the field of view produces a strong incentive for the eyes to fixate and accommodate for them, which incentive must be controlled by voluntary effort. The result of this opposition of voluntary control against strong reflex incentives is to tire the eye quickly and to make it lose the power to sustain the precision of adjustment needed for the clear seeing of the work.

(4) Brilliancies if too high may cause an actual damage to the retina itself. This damage may take the form of congestions and inflammations, scotomata or pathological blind spots, detachments, etc. . . .

Eye-strain.—In the attempt to understand the effects of bad lighting on the eye one of the most fundamental principles to keep in mind is that the eye is always under a reflex incentive to clear up its vision. This incentive is very strong, so strong that it is extremely difficult to oppose it successfully by an act of will or voluntarily to force the eye to make an adjustment detrimental to clear seeing. The eye has grown up under daylighting. Under this condition only three adjustments have developed and indeed only three are needed: the reaction of the pupil to regulate the amount of light entering the eye and to aid the lens in focussing the light from objects at different distances; and accommodation and convergence, to bring the object on the principal axis of the lens and the image upon the fovea, conditions necessary for the formation of the clearest images by the lens and for the best discrimination of these images by the retina. These adjustments take place under a sort of triple bond imposed by their common nerve supply, so strong that if one takes place the others also take place unless the power has been acquired of separating them, and even then their separation is accomplished only by great effort or strain. Artificial lighting with its unnatural and unfavorable conditions for clear seeing has come late in the history of the race and the eye has not developed any reactions or adjustments to meet the conditions imposed. Yet the incentive to clear up its seeing remains and leads to adjustments which, if allowed to take place, serve only further to blur rather than to clear up vision. For example, a change in accommodation which is a change designed to clear up an image blurred by changing the distance of the object is in no sense helpful, only harmful for clearing up an image blurred by bad conditions of lighting; yet so long as unclear seeing is present due either to a blurring of the image or unfavorable conditions for its clear discrimination by the retina, the eye will strive by the three adjustments at its command to remedy the deficiency. *This striving to clear up its vision by ineffectual maladjustments is the cause of what is commonly called eye-strain.* The misdirected effort or strain is of no service what-

ever to vision and leads rapidly to fatigue and exhaustion, to deformities slight in their physical magnitude but great in their functional importance, to inflammations and congestions, and to hypertensions and other conditions not found in a healthy eye. If the eye could only be educated to lie down under the bad conditions of seeing for which it has not specific corrective adjustment, the cause of vision would be just as well or even better served and the eye itself would be a great deal better off.

4. *White Light for Increased Efficiency*

W. N. POLAKOV, "Influence of Illumination on Accident Rate," *Personnel Journal*, 7:4-6 (1928); reprinted by permission of Williams & Wilkins Co.

The majority of investigators agree with Dr. Max Poser that "Daylight, being a diffused light, to which our visual organ is most adapted, causes the least eye fatigue as many experiments have shown." Ferree and Rand explained the influence of composition of light, which is a combination of the effects of wave-length and purity, stating that "The shorter the wave-lengths, and the greater the purity, the clearer is the image formed." "White light, which is made up of all the wave-lengths of the spectrum mixed in what is called a balanced or neutral proportion for the eye gives a better power to discriminate details on the printed page than any colored light of equal luminosity even though of spectrum purity." The reason for this is obvious: seeing is due to the difference of reflections from objects and their background. The ideal black body against ideal black ground will not be visible, but if placed against a favorable background of high reflective power it will stand out sharply and form a definite image. For this reason, the use of light with preponderance of any color forms an unfavorable background.

Obviously, therefore, the *intensity of light* is a relative term which should be considered only *in relation to the kind of light.* In the case of integral white light, the increase of visibility is in proportion to the increase of intensity or brightness. For colored light, however, the effect of increase of its intensity does not stand in direct proportion to speed and acuity of vision.

Ordinary artificial light is colored light. Such colored light, depending upon its hue and saturation, is strong only in its subjective effect. For this reason, as the tests by Ferree and Rand have shown, a superficial comparison of colored and colorless light usually results in the wrong impression that colored light is brighter. Visibility, however, under such light is poorer than under the white light.

Very interesting tests made by Frank E. Carlson of the National Lamp Works of the General Electric Company, on relative value of daylight, tungsten filament, and mercury arc light as measured by visual acuity, shows, considering the zinc plate results, "that the advantage seemed to go very decidedly to daylight, with tungsten and mercury vapor ranking second and third respectively, throughout the entire range of intensity." Likewise, the tests on the effects of mixing artificial light with daylight on important functions of the eye conducted at Bryn Mawr College, seem to indicate that for all intensities the artificial light gave the poorest results, the daylight the best, and the mixture in equal proportions an intermediate result. . . . The clearest vision, as well as the greatest speed, power to sustain, etc., occur under the wave-lengths of the mid-region of the spectrum. While the short wave-length forms clear images on the retina, the wave-lengths in the mid-region of the spectrum give the retina its highest power to discriminate detail in these images. Dr. Poser asserts, therefore, that the excess of the yellow rays in most of our artificial light sources should be neutralized in order to approach daylight. It is not necessary, according to him, to obtain absolute standard of daylight quality, as determined spectroscopically, for our light sense can overcome some variation of color combinations in the light source without experiencing fatigue. The Bryn Mawr investigators agree with him by stating, however, that "unfortunately *none* of our artificial illuminants are entirely colorless,—all have a dominant wave-length or group of wave-lengths." Obviously these illuminants do not radiate the wave-lengths of the spectrum which help maximum acuity of vision.

It is particularly important, in this connection, to remember that integrated white light (within the limits of spectral composition between sunlight and light under overcast skies) gives greater acuity of vision, greater speed of vision, more accurate discrimination of details, correct presentations of colors and hues, and is more gentle to the eye *without the necessity for the intensities which would be necessary with ordinary artificial light with predominating wave-lengths.* It is on this ground that Dr. Poser has arrived at the conclusions that fine detail work does not demand brilliant illumination, but a soft white light of moderate intensity. Such a light proves far more satisfactory and prevents eye fatigue.

In other words, any change in the present method of artificial illumination which would produce integral white light, would increase speed of vision, acuity, power of sustaining, and color discrimination with lower intensities than would be necessary with colored lights produced by incandescent filament in a gas-filled lamp

or vapor lamp. Furthermore, any change of lighting which makes the object easier to see at a lower level of illumination will also increase the speed of vision at the higher levels of illumination. This, translated into practical terms, means that *an artificial light of spectral value approximating sunlight or overcast sky light will reduce accidents, increase production, reduce spoilage, and prevent unnecessary eye-strain.*

B. Ventilation

5. *Fundamentals of Ventilation*

C. P. YAGLOGLOU, "Modern Ventilation Principles and Their Application to Sedentary and Industrial Life," *Journal of Personnel Research*, 3:376-377, 382-383, 389-391, 395-396 (1925); reprinted by permission of Williams & Wilkins Co.

Preliminary Theoretical Considerations.—All life processes are accompanied by the generation of heat within the body, through the oxidation of the food substances that are taken in. In other words the human body resembles a combined unit of boiler and engine, in which heat energy is liberated, and transformed into mechanical energy through the medium of muscles. The greater the muscular activity, the greater the heat produced in the body, which must be removed for life to exist.

If this heat is retained within the body, the subsequent rise of body temperature produces feelings of depression and discomfort, while death may occur within a comparatively short period of time. Under normal conditions the body maintains a temperature higher than the atmosphere environment, and it therefore loses heat to the surrounding air and objects. The constant temperature of the body indicates that the rate of heat loss is regulated, within limits, so as to be equal to the rate at which heat is produced.

Heat loss from the human body takes place in three different ways, namely, by radiation, convection, and evaporation. The body warms the surrounding objects and walls by radiation, in exactly the same manner as the sun warms the earth. The heated air in immediate contact with the surfaces of the body rises, due to its lower density, while cooler air takes its place, thus setting up convectional currents which carry away part of the heat developed by the body. In addition the air evaporates moisture from the surfaces of the body, which is cooled by supplying the latent heat required by this process.

It follows that the physical conditions of the atmosphere is the determining factor in heat loss, and therefore is of utmost im-

portance to human comfort. If the temperature of the surrounding air is the same as that of the body there will be no heat removed by radiation or convection, and all of the heat produced within must be disposed of by the evaporation of perspiration. On the other hand, if the humidity is high, or when the atmosphere is saturated at a reasonably low temperature, little heat will be lost by evaporation, the greatest part being removed, in this case, by radiation and convection.

Humidity is the water vapor or moisture that is present in the air. This quantity varies considerably, depending largely upon the weather conditions. In conjunction with the two principal constituent gases of air, namely, oxygen and nitrogen, water vapor has a partial pressure of its own, and the sum of the partial pressures of the three gases is equal to the barometric pressure. For every temperature there is a partial pressure of the water vapor at which the air is in a saturated condition, that is, it contains the maximum amount of moisture that it can hold at that temperature. This saturation temperature is called the dew point. As the temperature increases the partial pressure of the saturated vapor increases also. If the temperature drops below the saturation point some of the vapor will condense and its pressure is reduced, according to the new temperature.

Absolute humidity is the amount of water vapor actually present in the air, expressed in grains per cubic foot or per pound of air. The ratio of the vapor actually contained in the air to the maximum amount the air will hold at the same temperature is called the relative humidity. For example a pound of air at 70 degrees Fahrenheit with an absolute humidity of 55 grains per pound is only 50 per cent saturated since at this temperature saturated air holds 110 grains of moisture per pound. . . .

The Zone of Greatest Comfort.—A large number of people of both sexes totaling 130 in all participated in these experiments. Care was taken to select a representative group of people, engaged in different occupations and wearing customary but widely different types of indoor clothing. The psychrometric chambers were furnished with living room commodities and small tables were provided for light activities of the subjects, such as, card playing, reading, writing, and the like.

In preliminary experiments with 12 subjects the probable upper and lower boundaries of the comfort zone were established. Starting well outside these two limits with the total number of subjects, the probable conditions of maximum comfort were approached from both directions to eliminate any possible effect of acclimatization to the same temperature.

A fresh supply of conditioned air was provided at all times, the temperature of which was kept constant for about an hour, or until the subjects of the experiments formed definite opinions as to whether the condition was cold, comfortable or warm. The humidity during these experiments varied from 30 to 60 per cent, and no measurable amount of work was performed by the subjects.

The analysis of the results shows that at 58.5 degrees effective temperature the 130 subjects unanimously agreed that the condition was too cold, while an effective temperature of 72.5 degrees was pronounced too warm for comfort. These two effective temperature lines constitute the extreme lower and upper boundaries of the comfort zone.

At 61.5 degrees effective temperature half of the subjects were comfortable and the other half were cold, while at 70 degrees effective temperature the condition was pronounced comfortable by half of the subjects and too warm by the other half. This narrower zone may be taken as the comfort zone within which the average individual is comfortable.

Finally it was found that the conditions of maximum comfort are represented by the 64.5 degree, effective temperature line, irrespective of dry bulb or relative humidity, at which temperature about 98 per cent of the total number of subjects were comfortable. In round figures the 64.0 effective temperature line is the true comfort line to be adopted as the standard in heating and ventilating residences, schools, theaters, office buildings and all other places where mental work and light muscular activities are pursued. . . .

Application to Sedentary Conditions.—It is a well known fact that there is an optimum temperature of the environment most conducive to human comfort, and at which the body works most efficiently. This optimum temperature depends largely upon the nature of the work performed. The heat produced through the chemical changes within the body must be lost to the outside for the body temperature to remain constant. The greater the muscular activity the greater the heat produced, and the cooling power of the air should be correspondingly increased to effect a greater heat loss from the human body.

The optimum temperature for individuals at rest, or otherwise engaged in light activities, in still air and normally clothed was found by the Research Laboratory to be 64.5 degrees effective temperature. In round figures an effective temperature of 64 degrees should be adopted for dwellings, office buildings, theaters, schools and all other places where mental and light muscular work is performed in practically still air.

Although only the data for still air were determined experimentally by a great variety of individuals, a comparison of a number of equivalent conditions with still air and with 500 feet velocity, made by a few persons normally clothed, disclosed no definite variation. While all equivalent conditions are equally comfortable practical considerations limit the range of humidity to be ordinarily employed from 30 to 70 per cent. As a general rule relative humidities from 50 to 60 per cent will be found most desirable.

The influence of atmospheric conditions in factories and workshops upon the health and well-being of the occupants cannot be overlooked. The industrial worker spends the major part of his active life in an environment where heat, moisture, and in some special cases, injurious elements are constantly evolved by the process of manufacture. The conditions, as a result of their effect on the health and comfort of the workers, are chiefly responsible for the quantity and quality of output and, therefore, for the general efficiency of the plant.

In a report of the importance of temperature and humidity to physical work the New York State Commission on Ventilation states that men perform 28 per cent less physical work in a temperature of 86 degrees Fahrenheit with 80 per cent humidity than in one of 68 degrees Fahrenheit and 50 per cent relative humidity. An estimate of the daily loss in output in an average size industrial plant operating at an efficiency of 70 per cent will reveal the material financial loss resulting from failure to control the temperature conditions.

It is a comparatively simple matter to produce and maintain proper atmospheric conditions indoors in winter. In summer, however, with an outside temperature in the neighborhood of 95 degrees the problem becomes rather complicated. The incoming air diffusing into the workrooms takes up heat liberated from the machinery in operation and from the bodies of the workers, and its temperature is increased considerably.

While every factory is equipped with a heating system, little provision is made for cooling during the hot summer months, despite the fact that the greatest seasonal fluctuations in efficiency occur in summer.

It has been shown in general how high temperature conditions can be improved by means of saturation and air movement. As an actual application of the method the case of an automobile factory is taken, where the average summer observations available for 1923 were about 96 degrees dry bulb and 80 degrees wet bulb with practically still air. This condition corresponds to an effective tempera-

ture of 84.7 degrees, and that a velocity of 300 feet will improve the situation by only 3.5 degrees effective temperature. Saturating the air, however, the dry-bulb temperature is reduced to 80 degrees, and a velocity of 300 feet now applied will theoretically reduce the condition to about 72 degrees effective temperature producing a total improvment of 84.7—72.0=12.7 degrees effective temperature.

In practice these theoretical values cannot be attained. Allowance must be made for the increase in temperature and decrease in the humidity of the air in diffusing into the workroom before striking the bodies of the workers. In addition, the values will probably be affected by the clothing worn, and the type of work performed.

In large factories the process requires the use of humidifiers and blowers, the latter forcing through ducts the cool air directly upon the workers. In addition to the cooling effect, a fresh supply of air is provided at all times to remove the products of respiration and various other injurious elements evolved by the process of manufacture.

In small factories and workshops the desired cooling power of the air can be obtained by locally applied electric fans directing a current of air upon the workers. The velocity of the air being comparatively high a few feet from the fans the cooling produced by the wind alone will be sufficient in the majority of cases, without the use of humidifiers. . . .

Comfort and Health of Workers in Steel Mills and Allied Industries.—In the very hot industries of steel, iron, and tin manufacture the workers depend chiefly on evaporation as the only means of eliminating bodily heat. The work is hard and is carried out under trying conditions of temperature. The men stream with perspiration and drink many kinds of liquids to replace the loss by evaporation. Owing to the heat and excessive perspiration they usually work with the upper half of the body uncovered, and alternate short periods of work with resting periods in which they cool off.

Steel production is the most strenuous occupation in which thousands of men are engaged and often requires exposure to high temperatures which may reach to 220 degrees Fahrenheit a few feet from the furnace. In tinplate rolling mills the rollerman and behinder usually stand in temperature of from 100 to 120 degrees Fahrenheit working laboriously in the face of radiant heat from the furnaces and plates. In glass works the temperature in the vicinity of the furnace often reaches 140 degrees Fahrenheit, and the workers, like those in the metal industries, frequently rest while others take their places.

Continual exposure to these conditions is found to have an immense economic effect on the efficiency and health of the workers. They become susceptible to disease, and invariably suffer from anemia and muscular and joint pains which eventually induce premature old age.

A great deal has been done lately in an effort to improve working conditions. Forced air blasts have been introduced in a few cases blowing fresh cold air over the heads of the men with beneficial results. Such a system lowered greatly the temperature and improved considerably the efficiency in a tube plant in Pittsburgh. Its use has also been effectual in overcoming adverse heat conditions in bottle works and tin-plate factories and thus has increased considerably the output and decreased respiratory diseases.

Besides the lowering in temperature effected by the circulation of fresh cool air, the movement of the latter greatly increases its cooling effect upon the bodies of the men, and the work proceeds with shorter periods of rest which otherwise were spent in cooling off.

The experimental evidence in hand of the cooling laws of the human body is of great value in predicting just what is expected of a certain air velocity at a given temperature and moisture content when directed upon the bodies of lightly clothed individuals. This information further indicates that the most efficient system of ventilating hot workshops is one in which the air is cooled by saturation and then blown through overhead ducts directly over the workers. In addition to increasing the cooling power of the moving air, saturation provides moisture to the relatively dry air and thus eliminates the burning effect of the dry hot air and its influence upon the respiratory organs.

A condition of 112 degrees dry bulb and 86 degrees wet bulb existed in a steel mill in the Pittsburgh district with an average velocity of 100 feet per minute created by the natural circulation of air. It was observed that, in the hot summer months, the work did not proceed as fast as it did in winter, and improvements were contemplated through the installation of large blowers to effect a rapid circulation of air.

In summer, however, the temperature conditions outside are too high to effect any appreciable lowering in the temperature at the working places by this method. Furthermore, as mentioned previously, the effect of wind at these high temperatures is rather small to bring about a decisive improvement.

The effective temperature of the condition is 91.0 degrees, and by saturating the air at 86.0 degrees and blowing it on the workers with a velocity of 400 feet per minute, it is theoretically reduced to

80.0 degrees which is a good working temperature for steel mills. The cooling produced is 91.0—80.0=11.0 degrees effective temperature, while if the velocity of the air is increased to 700 feet, the corresponding effective temperature will be 74.5 degrees and the resulting cooling 16.5 degrees effective temperature.

If the workers could possibly derive the full benefit of the cool air bath these values will be realized in actual practice. In any case the improvement will depend on the effectiveness of directing the current of air upon the workers, and the temperature and humidity of the air as it strikes their bodies.

QUESTIONS

1. Explain in detail how a student should arrange his study table and chair with reference to windows and to artificial illumination.
2. What are some simple inexpensive methods of providing for proper ventilation?
3. Why is a high relative humidity a condition of the atmosphere with which the heat-regulating functions of the human being cannot cope easily?

CHAPTER XIII

ACCIDENTS

The passage of Workmen's Compensation Acts in most states and countries has thrown upon the employer the technical responsibility for preventing accidents and financial liability for them when they occur. At first the problem was attacked by the development of mechanical safeguards such as boxing in revolving machine parts, rigid inspection of tools, compulsory wearing of goggles, etc. Safety engineers have designed ingenious and elaborate systems of protection on the principle that dangerous parts should be removed when not in use and used only under certain restrictions.

It was soon discovered that while these devices decreased accidents to a large extent, the majority of mishaps were due to human rather than physical causes. Medical inspection at the time of employment was resorted to in the belief that persons disqualified on the ground of ill health, nervous instability, or previous injury could be identified before they became a menace to fellow workers. Many poor risks were undoubtedly eliminated thereby, since sensory defects do render a person more subject to certain types of accident. The numerous accidents which still occurred could be explained in no other way than in terms of certain qualities of the victim. The machinist who deliberately removed the protecting plates above the gears in order that he might feed his machine more comfortably is an instance of this. Temptation to exposure to danger might have been lessened had the safety mechanism been properly installed. Any device which interferes with free functioning of the worker is bad.

Just as various psychological tests have been used to select applicants who will eventually be better producers for the company, so similar batteries of tests have been constructed to select applicants who will be less susceptible to accidents. It has been demonstrated mathematically, theoretically, and experimentally that individuals vary widely in this respect. Some

persons, for example, are grossly deficient in a sense of spatial relations. A tendency to underestimate or overestimate distances may be fatal in certain circumstances. It is a task of the future to refine these measures so that more delicate discriminations can be made.

All accidents should be considered as outcomes of a complex set of antecedents. Some of these antecedents, such as fatigue, time of day and time of year, temperature, lighting, are causally related to the frequency of injury. Anything which betters these conditions will be sure to influence favorably the ratio of accidents to output. This viewpoint of the interrelation among variables is fundamental to all research in industrial psychology. Accidents, for example, hinge to some extent upon conditions in the environment, and much of the morale of the working force in turn depends upon the real or reputed dangers of a given industry.

Safety education has played a big part in prevention, but much of it could be more effectively conducted. Placards and warnings do little good unless they are conspicuous and certain to be read. Attention-getting devices should be used repeatedly; pictures with a humorous note are preferable to those of tragic vein. That training is effective can be seen in the relation of injuries to length of service with the company. New employees show an accident rate many times greater than that of veterans, and the proportionate diminution is noticeable from month to month. However, it should be emphasized that when older employees do have accidents, their injuries seem to be more serious and the time of recovery is more prolonged. The resisting and recuperative powers of the organism obviously diminish with age.

A. External Factors in Accidents

1. *Unexpected Conditions*

Boyd Fisher, ***Mental Causes of Accidents***, **1-2 (Houghton Mifflin, 1922)**

Are we to blame for our minds? Even girls with high-heeled shoes should not have fallen down that stairway. It was a straight flight, placed where you would expect it to be; it was well lighted and guided by a hand rail. The steps were wide enough and covered with safety treads. Surely, it had no hazard in itself; and

yet clerks, perfectly familiar with the fact that others had been injured there, and accustomed to using the stairs every day, on several occasions plunged headlong the whole length of the flight. We held many indecisive conferences at the Aluminum Castings Company about these stairs, which seemed to have the very devil in them. One day we happened to measure the width of the steps to compare with another flight. We were surprised to learn that the first step below the landing was two inches wider than all the rest below it. The secret was then out. A girl would take her first step down, looking where she put her foot, and adjusting it to the usual position on the edge of the step. Subconsciously she noted the width, and assumed that all of the other steps were exactly as wide. Then she placed her foot on the next lower step two inches too far forward, lost her balance, and came stumbling down to the bottom.

The remedy, of course, was to extend the landing out two inches so that the steps were, then, all the same width. But, granting the necessity of doing that, one could not properly say that the steps were wrong. Taken singly, they were all right. The cause of the accident really lay in the subconscious mental operation of the person using these stairs. And this case is suggestive of many situations in which accidents occur because a perfectly normal automatic assumption by the mind does not record with the realities.

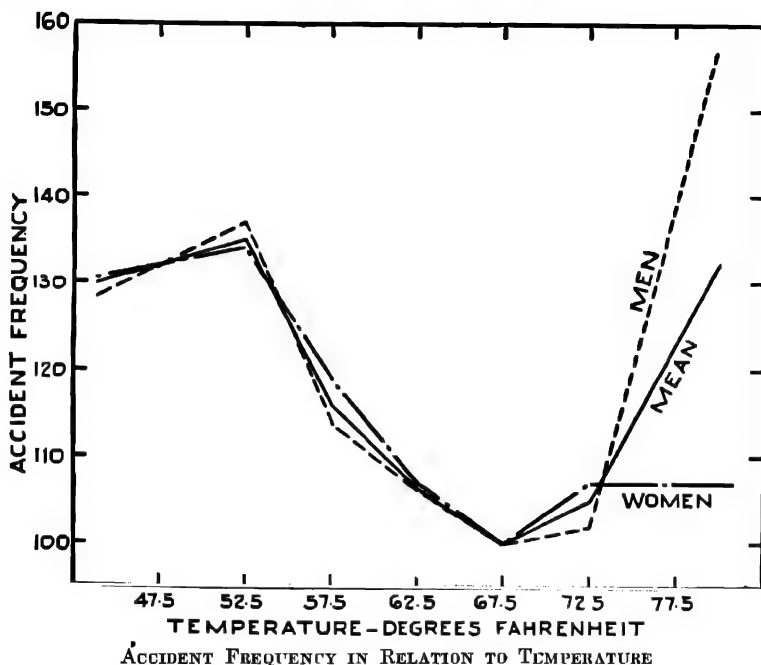
2. *Influence of Temperature and Other Conditions on Frequency of Industrial Accidents*

ETHEL E. OSBORNE and H. M. VERNON, *Two Contributions to the Study of Accident Causation*, Report No. 19 of the Industrial Fatigue Research Board, 17 (His Majesty's Stationery Office, London, 1922)

The number of accidents (cuts) experienced by the workers at three munition factories was found to be greatly influenced by temperature. The temperature was registered continuously for 9 to 12 months at a projectile factory and a 6-inch shell factory by means of thermographs, and it was found that the accidents at the shell factory agreed with those previously observed at a fuse factory in reaching a minimum at 67° Fahrenheit. At the projectile factory the minimum was at 72°, but the combined results gave 67° as the minimum. With fall of temperature the accidents increased gradually, and to a similar extent in men and women, till at 52° they were 35 per cent more numerous. At temperatures above 72° they increased very rapidly in men, but only to a small extent in women.

The hourly incidence of accidents experienced by the day shift at

the projectile factory showed a qualitative resemblance to the output variations. They were low at first, rose to a maximum in the middle of the shift, and then fell away. The night shift accidents, however, showed no resemblance whatever to output, except during the last two hours. They were at a maximum during the first hour,

Accident Frequency in Relation to Temperature

then fell off sharply, and finally sank to less than half their original number. Probably this incident was largely psychical in origin.

The influence of fatigue in causing accidents was shown at the 6-inch shell factory. When the women worked the same 61-hour week as the men, their accidents were 91 per cent as numerous, but when their hours were reduced to 39½ a week (those of the men being unchanged), their accidents fell to 78 per cent of those experienced by the men.

3. *Speed versus Accuracy and Safety*

B. Muscio, *Two Contributions to the Study of Accident Causation,* Report No. 19 of the Industrial Fatigue Research Board, 36 (His Majesty's Stationery Office, London, 1922)

Data are given in this report showing that (1) an increase in rate of movement (for certain rates used) causes an increase in

the inaccuracy of movement, and that the faster the rate in operation at any time, the greater in general is the increase in inaccuracy produced by any unit increase in rate; (2) Continuous work for several hours (in one case for 3½ hours) with tests of motor precision fails to show a gradual increase in inaccuracy but the very reverse, the resulting inaccuracy curve being almost the exact opposite of the typical industrial accident curve for the morning hours; (3) a curve for inaccuracy of movement, broadly similar to the typical industrial accident curve for the morning hours, can be experimentally obtained by gradually increasing the rate of movement in the morning period of continuous work with motor precision tests.

TABLE I

SHOWING THE RESULTS FOR SIX DIFFERENT RATES IN AN AIMING TEST FOR EACH SIX SUBJECTS

Each number in the table obtained by adding together the distances of 180 shots, each scored to the nearest half millimeter, from the circumference of the bull's eye; these 180 shots [at each rate] being distributed over six sittings.

Subject	Rates (Metronome)						Totals
	60	90	120	150	180	210	
A	223.5	228	326	406.5	542.5	684.5	2411.0
B	210	270.5	304	417.5	556	588.5	2346.5
C	120.5	111.5	173.5	263	334.5	556	1559.0
D	223	182.5	193.5	301.5	419.5	476	1796.0
E	148.5	126	148.5	195	305	364	1287.0
F	135	163.5	194.5	224.5	321.5	367.5	1406.5
Average	176.8	180.3	223.3	301.3	413.1	506.1	1801

In view of what is known concerning hourly variations in speed of production, the conclusion suggested by these results is that the principal factor in the hourly variations in the number of industrial accidents is *not* "fatigue," but *rate of work.* There *may* be hours of the work-day for which this conclusion is not true, and the question whether this is so or not is highly important; but the conclusion seems true for the morning hours at least.

It is suggested that further experimental data should be collected bearing upon the present question. Results should be obtained from a greater number of subjects than took part in the present experiments; longer periods of continuous work should be used; and tests (of muscular accuracy) involving a greater ex-

penditure of energy than the *aiming* and *pendulum* tests, should be employed. Modification of the present experiments in any of these ways might yield results more or less different from those given in the present report.

B. Individual Differences in Susceptibility to Accidents

4. *The Distribution of Industrial Accidents*

M. GREENWOOD and HILDA WOODS, *Incidence of Industrial Accidents Upon Individuals with Special Reference to Multiple Accidents*, Report No. 4 of the Industrial Fatigue Research Board, 3-5, 7-9 (His Majesty's Stationery Office, London, 1919)

When a number of persons engaged upon a specific task is observed over a period of some weeks or months, they are often found to have sustained a certain number of casualties; if such casualties are so trivial as to permit the victim to continue work, it may also be observed that the same person is injured more than once, so that the statistics of the whole period provide a certain number of persons who have passed through unscathed, some who have been injured once, others who have been injured twice, and so on. . . .

Let us suppose that 100 equally capacious and equally accessible pigeon holes are bombarded with 20 balls, none of which can fall clear of the pigeon holes altogether, then the chance of any one ball lodging in any particular pigeon hole is one in a hundred, and at the end of the bombardment the distribution of pigeon holes with 0, 1, 2, etc. balls in each is given by the 21 successive terms of:

$$100\left(\frac{99}{100}+\frac{1}{100}\right)^{20}$$

But the pigeon holes might not be of equal size. If some were very much larger than others, the former would receive a greater share of the balls and the distribution would be very different from that just given. Similarly if the pigeon holes changed size after the bombardment had commenced, the distribution would be affected. The extreme limits of the two modifications would be reached if either (*a*) all the pigeon holes save one were covered in, when the final distribution would necessarily be 1 pigeon hole with 20 balls and 99 with none, or (*b*) if directly a ball entered a pigeon hole a lid fell—as in the trap nest of a poultry fancier—which would lead to an ultimate distribution of 80 pigeon holes with no balls and 20 with one each.

These examples, although their analogy to the subject we are

engaged upon is but imperfect, start a train of thought. Knowing the form of the ultimate distribution of pigeon holes with various numbers of balls, it is evidently practicable to form a judgment as to the nature of the causes which have operated in the distribution, since these will completely determine the result. We say advisedly *"form a judgment as to"* and not *"prove what was"* because an inverse problem of this kind presents certain difficulties which we have no space to discuss. Following up this trail might it not similarly be possible, from a consideration of statistics of multiple accidents, to reach a judgment as to factors producing these?

To make our point clear, let us discuss the genesis of accidents more at large. We have not, however, to consider any general influences common to the whole number of persons studied. Such influences will not affect the distribution of accidents as between individuals, but will modify the general scale; they are of course of immense importance, because they may determine the total numbers of accidents sustained, but need another method of investigation and have in fact been studied by other workers. We are only dealing with the differentiation of individuals.

The simplest hypothesis is that there is *no* differentiation, that industrial accidents are really accidents in the strictest sense, just as it is an accident if one draws the ace of spades from the well-shuffled pack, an accident if a particular pigeon hole receives a ball at any particular throw and so on. In that event, the statistics of multiple accidents would conform to the type of a pure chance distribution of which the first arrangement of pigeon holes imagined above is one illustration.

The most obvious modification of the pure chance scheme is to suppose that the workers did all start equal, but that an accident having happened to any individual that individual's chance of sustaining a second accident became different from what it was before. Such a train of events is common enough in human life. A person may acquire some disease by the merest accident, but passing through the attack will profoundly modify his chance of acquiring it again when the original conditions are, in all other respects, reproduced; he may be practically immune or conversely he may be much more sensitive to infection. The analogous schema in our sets of pigeon holes is that of the trap nests, although the analogy is imperfect because in that case not only is the future chance of the particular pigeon hole modified, which is correct, but, by the conditions that all 20 balls must ultimately rest somewhere in the 100 pigeon holes (introduced for simplicity) the chance of the empty pigeon holes is also modified, which is wrong,

for the happening of an accident to our person should not generally affect anyone else's chance.

Thirdly we might suppose that all the workers did not start equal, but that some were more liable to suffer casualties than others; suppose there were only two classes, clumsy and careful people, then the analogy would be 100 pigeon holes, 50 having an opening of 1 square foot and 50 having an opening of 2 square feet and we should get another special distribution of multiple accidents.

These three hypotheses correspond to three distinct policies of organization.

If industrial accidents were found to be allocated upon a pure chance schema, the diminution of their number would be effected by a change of scale through administrative reforms inspired by researches into general conditions, but not into the individual physiology or psychology of the worker. Were the second mentioned hypothesis in better accord with the facts, there would be need for consideration whether the enhanced liability to accident after a first casualty (supposing the bias were in that direction) might not be reduced, perhaps by a compulsory period of rest, possibly by a short interval of different work. If, on the other hand, the third possibility materialized, it would follow that both initial selection of recruits and also a rapid elimination of those sustaining multiple accidents should have a great effect in reducing the casualty rate of the factory. . . .

These three methods then, that of a Simple Chance Distribution (denominated in our tables by the letters C.D.), that of a Biassed Distribution (entered as B.D.), and that of a Distribution of Unequal Liabilities (indicated by U.D.), have been used throughout. A criterion of agreement between the deductions from the formulæ and the statistical facts has been obtained by using Professor Pearson's Goodness of Fit Test. . . .

The C. D. hypothesis is altogether inadequate, while in a majority of cases the other two hypotheses provide good fits; but on a general review of the data it is apparent that the U. D. method is decidedly superior. In five cases the B. D. distribution fails, the U. D. only twice (it is noteworthy that two sets of data which neither hypothesis fits are mere enumerations of totals employed and therefore the guarantee of equal exposure to risk is much slighter than in other cases). The superiority of the method of Unequal Liability is not a mere consequence of using a formula with one more constant; two moments are involved in each calculation; hence it appears just to infer that the hypothesis of the deviation from simple chance being dependent upon unequal initial

liability to accident is sustained. We now proceed to examine the point more strictly.

It is evident that if the C. D. principle held, the previous record of any individual would be without influence upon his or her subsequent experience, just as if in one particular set of tosses a certain coin fell heads five times running, that coin would be neither more nor less likely to fall heads five times in a subsequent experience.

TABLE I

Mean Number of Accidents Per Month (Period February, 1917—July, 1918)

Month	136 Women Having No Accidents in February	62 Women Having Accidents in February	Difference and Probable Error
February	...	1.31	
March	.06	.65	.59 ±.04
April	.30	.45	.15 ±.07
May	.10	.21	.11 ±.04
June	.26	.40	.14 ±.07
July	.01	.03	.02 ±.02
Total	.15	.41	.26 ±.06

But if some one coin were biassed in favour of falling heads, then its records in successive experiments would naturally be interrelated. Having in some of our data records of previous experience, we can easily determine which case responds to the reality, and in Table I are set out the records of women who in a particular month did or did not have accidents. It will be seen that almost invariably the balance of accidents is heavily against those women who fell victims in the month taken as a criterion of classification. . . .

These results indicate that varying individual susceptibility to "accident" is an extremely important factor in determining the distribution; so important that given the experience of one period it might be practicable to foretell with reasonable accuracy the average allotment of accidents amongst the individuals in a subsequent period. This result is in itself of considerable interest, because it shows that by weeding out susceptibles the accident rate would necessarily decline.

5. *Analyzing Accidents*

E. M. NEWBOLD, *A Contribution to the Study of the Human Factor in the Causation of Accidents*, Report No. 34 of the Industrial Fatigue Research Board, 25-26 (His Majesty's Stationery Office, London, 1926)

An increasing number of factories are now keeping minor accident records and making periodical analyses of them (it is surprising incidentally to find even among those whose accident records are fairly detailed, how few refer them to the numbers employed). Such analyses, especially when they give details of the cause and type of accident, are of the greatest value in accident prevention. The distributions obtained in this enquiry suggest that a further step (which involves very little extra arithmetic) might be taken in such periodical summaries, in cases where the works can be divided into fairly homogeneous departments. The average number of accidents per person in any given department is usually calculated as a basis of comparison; if we want to find how to lower this number the first question that arises is, is the average due to conditions arising from the work or environment which on the whole affect in more or less the same degree all the workers in the department, or is it on the other hand largely affected by a small group of people having many accidents and exposed to special risk, whether such risk arises from personal qualities or individual differences in their conditions of work? Clearly these two cases call for different remedies. A rough approximation to an answer can quickly be obtained by finding the percentage of people in the department who have no accidents, and from the following table seeing what the mean number of accidents per person should be if all were exposed to the same risk.

If it is found, as in most of the groups here examined, that the observed mean is greater than the theoretical mean obtained from this table, then it is probable that the number of accidents in the department is unduly affected by the few people who have many accidents, and observations and experiment among these few may result in finding where the cause is. . . .

If on the other hand the observed mean is not higher than that deduced from the zero group, then it is probable that the accidents that occur are not so much due to individual differences either of work or temperament, but that the causes lie in the general type of work or environment which is common to all the workers in the group, and the remedy lies in looking to these conditions. It is perhaps not unnecessary to repeat the warning given before about the difficulty of distinguishing between a real and an apparent high

or low average. It is often the case that diligence in reporting accidents varies in different departments, but it lies in the hands of the factory officials to keep a high standard in this respect. Immediate reporting is in some places encouraged by compensation awards above those legally due, and by penalties for neglect to report even slight injuries.

TABLE I

TABLE FOR A ROUGH DETERMINATION OF THE EXISTENCE OF INEQUALITY OF ACCIDENT RISK IN A DEPARTMENT

Percentage of Persons Having No Accidents $100e^{-m}$	Corresponding Mean Number of Accidents per Person on "Equal Risk" Theory m	Percentage of Persons Having No Accidents $100e^{-m}$	Corresponding Mean Number of Accidents per Person on "Equal Risk" Theory m
90.0	.1054	2.25	3.7942
85.0	.1625	2.00	3.9120
80.0	.2231	1.80	4.0174
75.0	.2877	1.60	4.1352
70.0	.3567	1.40	4.2687
65.0	.4308	1.30	4.3428
60.0	.5108	1.20	4.4228
55.0	.5978	1.10	4.5099
50.0	.6931	1.00	4.6052
45.0	.7985	.90	4.7105
40.0	.9163	.80	4.8283
35.0	1.0498	.70	4.9618
30.0	1.2040	.60	5.1160
27.5	1.2910	.50	5.2983
25.0	1.3863	.40	5.5214
22.5	1.4917	.35	5.6550
20.0	1.6094	.30	5.8091
17.5	1.7430	.275	5.8962
15.0	1.8971	.250	5.9915
12.5	2.0794	.225	6.0968
10.0	2.3026	.200	6.2146
9.0	2.4079	.180	6.3200
8.0	2.5257	.160	6.4378
7.0	2.6593	.140	6.5713
6.0	2.8134	.120	6.7254
5.0	2.9957	.100	6.9078
4.5	3.1011	.090	7.0131
4.0	3.2189	.080	7.1309
3.5	3.3524	.070	7.2644
3.0	3.5066	.060	7.4186
2.75	3.5936	.050	7.6009
2.50	3.6889	.040	7.8240

6. *Questionnaire for Mental Post-Mortem on Accident Cases*

BOYD FISHER, *Mental Causes of Accidents*, 284-286 (Houghton Mifflin, 1922)

In appraising the mental condition of each victim of an accident, consider assignment, training, adjustment, physical condition, and emotional situation.

I. Assignment
1. Is he a "repeater"; i.e., prone to accident?
2. Does the subject understand plain instructions readily? Does he speak English?
3. Has he intelligence enough for the job?
4. Is he physically adapted to the job?
5. Has he adequate sense endowment for the job; i.e., is he too slow, too lacking in precision of movement, is he hard of hearing, or has he poor vision?

II. Training
6. How long has he been on the job? What is his chance of accident for this length of employment?
7. What regular habits are necessary for the safe conduct of this particular job?
8. What habit training has the victim so far had for his job? What improvement should be undertaken?
9. What mental approach is best in undertaking instruction of this particular worker?

III. Adjustment

A. Job Situation
10. Is the man earning a wage sufficient to keep him in comfort and fair contentment? Consider whether the job permits this.
11. Has he lately fallen behind his usual earnings, for any reason?
12. Has he been turning out a satisfactory quality of work?
13. Has he had any trouble with foreman or fellow workers?

B. Attitude
14. Has he any mental attitude of resistance to the guidance of the management? Does he coöperate in carrying out instructions? Is he open-minded to new ideas? Is he unduly superstitious?
15. Has he any constitutional bravado and recklessness?
16. Has he any "pose" inconsistent with safe practices?
17. Is he enthusiastic about his job? If not, how could he be made so?
18. Has he a basis for hope of personal distinction and advancement in his work? If not, what could implant such a hope?

C. Personal Situation

19. Has he illness or any other crisis at home?
20. So far as properly may be determined, has he a normal sex-life?
21. Is he suffering from any undue burden of debt or other financial worry?
22. Is there any occasion for him to fear or brood over legal or other personal complications such as quarrels or thwarted ambitions or desires?

IV. Physical Condition

23. Was the man ill at the time of the accident? or recently?
24. Has he suffered from any organic impairment affecting his efficiency?
25. Was the man overworked or overstrained at the time of the accidents?
26. Were conditions of ventilation, illumination, heating, etc., such as to cause depression?
27. Is there undue noise and disorder in connection with his work?
28. Was there any confusion of orders, change of work or discord to distract his attention?

V. Immediate Emotional Situation

29. Was the victim unduly excited or noticeably depressed at the time of accident?
30. Had anything happened to anger, frighten, discourage, or distress him?
31. Is he considered, by his associates, mentally sound?

7. *An Experimental Approach*

E. Farmer and E. G. Chambers, *A Psychological Study of Individual Differences in Accident Rates*, Report No. 38 of the Industrial Fatigue Research Board, 2-3, 17, 36 (His Majesty's Stationery Office, London, 1926)

The great difficulty to be met in all investigations of this kind is variation in the exposure to risk on the part of the individuals studied. Since the most obvious explanation of inequality in number of accidents incurred is a corresponding inequality in exposure to risk, it is all the more important not to assume without definite proof that varying individual susceptibility is the cause. In the case of the statistical inquiries, the method adopted was to select only individuals in any group who were employed in manufacturing the same article in the same way, but such equality of exposure was admittedly but a rough approximation, since the conditions of exposure may in practice be so variable that complete uniformity over a long period could not be assumed. In the present investigation the question of individual susceptibility has been explored in

another way. Various psychophysical tests have been given to groups of factory workers and it has been found that those who did well in certain of them tended to have fewer accidents than those who did badly. On the hypothesis that inequality in accident rate is entirely due to inequality in exposure to risk, we should have to make the assumption that those who did well in the tests were subsequently exposed to less risk than those who did badly, in spite of the fact that no one who had any connection with the allocation of their tasks had any knowledge whatever of the results of the tests. Such an assumption amounts practically to an impossibility, especially when the same phenomenon is observed in different groups, and so we are led to the conclusion that inequality in accident rate is, in part at least, determined by the quality or qualities measured by the tests. The operation of this quality (or qualities) can be measured, and the difference between the number of accidents prognosticated by means of the tests and the actual number sustained by the group is a clear indication of how far other factors are operative. This process can be continued until all the measurable factors have been examined and the residue of accidents that still remains must be put down to unknown or unmeasurable factors, one of which may be inequality in exposure to risk.

The fact that one of the factors connected with accident liability has been found to be a peculiarity of the individual allows us to differentiate between "accident proneness" and "accident liability." "Accident proneness" is a narrower term than "accident liability" and means a personal idiosyncrasy predisposing the individual who possesses it in a marked degree to a relatively high accident rate. "Accident liability" includes all the factors determining accident rate; "accident proneness" refers only to those that are personal. We do not know yet whether accident proneness is a general or a specific factor, but if it should ultimately be found to be a general factor, then an individual working in a dangerous trade with a low degree of accident proneness would have a relatively low accident liability as compared with others engaged in that trade, though it would be greater than that of an individual with an equal degree of accident proneness working in a less dangerous occupation.

Care must be taken not to make accident incidence *per se* a measure of accident proneness, for this is to adopt the position of those who say that accidents are due to carelessness and when asked to define carelessness they do so in such a way as to leave little doubt that by carelessness they mean having an undue number of accidents. "Accident proneness" implies the possession of those

qualities which have been found from independent research to lead to an undue number of accidents. If the term is used in this way, a person can be said to be accident prone without any knowledge of the number of accidents he has sustained, for this statement will merely mean that he is more likely than others in equal conditions of exposure to sustain accidents. Such a knowledge would make it possible to warn certain people against entering dangerous occupations, so that, although they were accident prone in a relatively high degree, they might go through life with very few accidents. . . .

The apparatus used was Schuster's modification of the McDougall machine. The subject was required to dot a series of small circles passing in front of him at an increasing speed. . . .

The results from the dotting tests are given in Table IV, in which it will be seen that those who do better than the average have a lower accident rate in every group than those who are worse than the average. The difference of the weighted averages is just over four times its probable error, so that it may be regarded as fully significant. The dotting test is the easiest and quickest of all the tests to give, and can be given by any intelligent person without special psychological training. For these reasons it is admirably fitted to become a practical test, and the fact that it serves to differentiate the accident-prone is very fortunate.

TABLE I

ACCIDENT RATE EXPRESSED AS A PERCENTAGE OF THE MEAN OF THOSE BETTER AND WORSE THAN THE AVERAGE IN THE DOTTING TEST

Group	Better in Test	Worse in Test
A	41	153
B	90	112
C	71	122
D	76	124
E	79	123
F	72	126
Weighted averages	74	125
Difference	51	
Probable error of difference	12.0	

Conclusions.—(1) From the foregoing experiments the definite conclusions can be drawn that inequality in accident liability is

not solely determined by external factors, or by chance, but is due in an appreciable degree to measurable individual differences. Even complete knowledge and perfect measurement of such personal differences will never make it possible to say with certainty whether any particular individual will or will not sustain an accident under given circumstances, but the present results suggest that it is practicable to determine in a rough way the probability of any individual sustaining an undue number of accidents, and as more research work is done and the methods become more refined, this probability should tend to approximate more and more to certainty. It must, however, be borne in mind that at present the reliability of the tests has not been established, and until this is done they cannot safely be used for prognosticating the accident proneness of individuals.

(2) A relationship has been shown to exist in the subjects examined between accidents on the one hand, and poor "æsthetokinetic coördination" and nervous instability on the other. No relation has been found between accidents and the higher intellectual processes. The intermediate processes involving the special abilities and more highly integrated æsthetokinetic coördination have not been examined.

(3) There is a slight indication that the accident prone are industrially inefficient and more liable to report sick, and so react unfavourably to their total environment. This needs confirmation.

(4) No attempt has been made to distinguish between specific and general factors in personal proneness to accidents. This will have to be examined in a further enquiry.

(5) A positive correlation has been found to exist between major and minor accidents in most of the groups examined. The relationship differs in different trades and in some does not seem to exist.

(6) The final weighted results show a difference of 48 per cent in accident rate between those above and those below in averages in the tests.

8. *Measuring Accident Susceptibility*

E. FARMER and E. G. CHAMBERS, *A Study of Personal Qualities in Accident Proneness and Proficiency*, Report No. 55 of Industrial Health Research Board, 59-60 (His Majesty's Stationery Office, London, 1929)

Greenwood, Yule and Newbold have shown that the distribution of accidents is a skew one, yielding a J-shaped curve. This means that a large proportion of any group sustains no accidents at all

or very few, and a relatively small proportion sustains a large number of accidents, so that a high percentage of the total number of accidents in any group are incurred by comparatively few members of the group. The accident distribution of every group of subjects in the present investigation conforms to this type and agrees with the original conclusions of the above investigators.

In order to see how far the tests used in this investigation would serve as a practical means of detecting the accident prone, four groups of dockyard apprentices were ranked (1) according to their weighted æsthetokinetic score, and (2) according to their combined weighted æsthetokinetic and entrance examination score. Each group was then divided into quartiles and the accident rate of the worst quartile compared with the accident rate of the remaining three quartiles. Weighting the groups by the numbers of subjects in them and combining them into one group, the following results emerged:

(1) Ranking by weighted æsthetokinetic score
  Accident rate of worst quartile = .73 per man per year.
  Accident rate of remainder = .37 per man per year.

(2) Ranking by combined weighted æsthetokinetic and entrance examination
  Accident rate of worst quartile = .88 per man per year.
  Accident rate of remainder = .34 per man per year.

Expressed differently, the above figures mean that the worst 25 per cent of the dockyard apprentices, as measured by the æsthetokinetic tests, have an accident rate approximately *twice* that of the remaining 75 per cent, and when measured by the æsthetokinetic tests and the entrance examination, approximately *two-and-a-half* times that of the remaining 75 per cent. Hence, if 25 per cent of the apprentices had been rejected by their failure in the selective tests suggested, a group of boys would have been eliminated whose accident rate was more than twice as great as that of the successful apprentices.

The results obtained from the R.A.F. apprentices show that boys who do well in these same tests also tend to be more proficient in occupations very similar to those of the dockyard apprentices. If these tests were put into practice it may be presumed that they would have the effect not only of rejecting a small number of boys with a high accident rate, but also of selecting a large number of boys who on the whole would be more industrially proficient than those rejected.

9. *Individual Susceptibility to Accidents*

C. S. SLOCOMBE and W. V. BINGHAM, "Men Who Have Accidents: Individual Differences Among Motormen and Bus Operators," *Personnel Journal*, 6:252-257 (1928); reprinted by permission of Williams & Wilkins Co.

Susceptibility to Accidents an Individual Matter.—A canvass of the company's records showed that accidents do not distribute themselves impartially among the men who operate the cars. Half the accidents happen to less than a third of the operators. In one sample of two hundred men of ample experience and maturity in the service, half the accidents happened to only one-fifth of the motormen.

This difference in proneness to accidents holds even when the question of blame is eliminated. If consideration is given to only those accidents for which the operator is not to blame, it still is the case that a large proportion of them happen to a relatively small fraction of the men. Obviously some motormen are much more able than others to *avoid* accidents for which blame would fall on the pedestrian or truck driver. Our question then takes this form: What are the observable differences between the safer operators and those who from their records may be classed as prone to be victims of accidents.

The Relation of Accidents to Operating Ability.—The first step was to determine whether there is any relationship between the operator's driving ability and the number of accidents he has. The old difficulty of finding a suitable criterion or index of driving ability cropped up. After due consideration it was decided to take as the index of a man's ability his percentage of coasting. As one means of economizing electric power, the men are trained and urged to coast—that is, to let the car run without application of either power or brakes. Moreover, a perfectly objective measure of their percentage of coasting time was at hand. Each car is equipped with a clock which automatically records for each trip the total number of minutes during which the car is running without using either power or brakes. This coasting time divided by total trip time gives a coasting percentage. Like other such criteria, coasting time is influenced by almost innumerable factors other than the man's driving ability; but it is an objective criterion, and is certainly in some measure related to the operator's skill and his ability and willingness to keep his mind strictly on the job. . . .

The 100 best coasters and the 100 poorest coasters in the company were selected and the number of accidents which they had

in nine months compared. The number of delinquencies of various sorts recorded on their service records were also tabulated.

TABLE I

SHOWING THAT MEN WHO OPERATE ECONOMICALLY TEND TO OPERATE SAFELY AND ALSO TO GIVE MORE SATISFACTORY SERVICE

Operator	Accidents	Delinquencies
Men with low coasting record..........	364	73
Men with high coasting record	313	46

Table I shows clearly that the low coasting men are more liable to have accidents than are the high coasting men. It also shows that the service rendered by the men to the public and the company is also related to number of accidents and to coasting percentage.

Two explanations are possible. The men who are less economical of power make these coasting percentages because they are less skilled in the driving of their cars, and the number of accidents which they have is also a result of this comparative inefficiency. Or, low coasting record men have higher accident records because they are more often careless and negligent in their driving. We shall shortly see reason to question the usefulness of the concept of carelessness. . . .

Physical Condition in Relation to Accidents.—All men over fifty years of age are given an annual medical examination. Among the items measured and recorded are blood pressure, systolic and diastolic. Men whose blood pressure is strikingly abnormal are induced to seek special medical treatment or are given other work, or if necessary are pensioned. This is not uncommon in railway practice, since the management cannot afford the risk of leaving a street-car or a locomotive in charge of an operator who might be subject to a stroke, or to loss of consciousness in case of sudden emergency. It has not been generally recognized, however, that excessive blood pressure, even when it is not so high as to indicate danger of sudden collapse, may nevertheless be a symptom of incipient nephritis or of some systemic condition which affects general health and temperament to an extent which may seriously interfere with safe driving.

The data as to blood pressure of 59 men over fifty years of age were submitted to a medical authority who classified them as normal or abnormal. Then their accident records for the preceding year were examined. (It should be borne in mind that more than 80 per cent of recorded accidents are of a minor sort.)

Table II shows the association between number of accidents and blood pressure. It appears that men over fifty years of age with abnormal blood pressure had on the average somewhat more than twice as many accidents as did men of comparable age and experience with normal blood pressure. . . .

TABLE II

RELATION OF BLOOD PRESSURE AND ACCIDENTS

Men Over 50	Number of Men	Total Number of Accidents	Average Per Man
With abnormal blood pressure......	21	136	6½
With normal blood pressure........	38	110	3

From a practical viewpoint, if an abnormal condition of the circulation is affecting a man's behavior, there is not much use in suspending him or reprimanding him for carelessness.

10. *Sex Differences in Proneness to Motor Vehicle Accidents*

M. S. VITELES and HELEN M. GARDNER, "Women Taxicab Drivers," *Personnel Journal*, 7:350-354 (1929); reprinted by permission of Williams & Wilkins Co.

In Table I is shown a comparison of accidents to men and women drivers in the District of Columbia during 1927.

It is evident that the percentage of men drivers involved in both fatal and non-fatal accidents is greater than is to be expected on the basis of chance, whereas the percentage of women drivers involved in accidents is less than chance. . . .

Although the burden of evidence of these studies is in favor of the women drivers, however, it is subject to certain limitations which make it impossible to draw from it the conclusion that women drivers are safer drivers than men. Among these limitations are the following:

1. The evidence fails, in the first place, to include a comparison of accidents per mile of driving. It is safe to assume that the average number of miles covered by male operators is considerably in excess of the average number covered by women drivers.

2. It also seems reasonable to assume that, on the whole, men operate under more unsatisfactory driving conditions than do women. A greater portion drive in heavier traffic and in stormy weather than is the case with women.

3. Only male drivers operate trucks and other heavy vehicles,

in the case of which the proportion of accidents is greater than among lighter vehicles.

4. It is possible, although this may be difficult to demonstrate that the mechanical condition of machines driven by women is, on the average, better than those driven by men. It seems true that the second-hand cars are more often bought and operated by men than by women.

It is with a purpose of avoiding such variables that the study described following the table was undertaken.

TABLE I

COMPARISON OF ACCIDENTS TO MEN AND WOMEN AUTOMOBILE DRIVERS; DISTRICT OF COLUMBIA (1927)

	Men	Women	Unknown	Total
Licensed operators	104,565	18,435	...	122,900
Non-fatal accidents	4,092	282	329	4,703
Fatal accidents	76	2	5	83
	Per Cent			
Licensed operators	85	15	...	100
Non-fatal accidents	87	6	7	100
Fatal accidents	91.6	2.4	6	100

Men and Women Taxicab Operators.—This study involves a comparison of accidents to men and women taxicab drivers in a large Eastern city between March 1, 1927 and February 28, 1928. . . .

The following conditions of importance in accident causation were relatively constant for the two groups:

1. Type of vehicle operated: Both men and women drivers operated the standard taxicab of the type manufactured by the Yellow Truck and Coach Company. In one respect the women were favored, inasmuch as only the new cabs were assigned to them. Although these are somewhat easier to operate than the older cabs, there is probably no difference between the two from the point of view of safety.

2. Mechanical conditions of the cabs: The operating mechanisms of the cabs operated by men and women were in the same condition. The cabs operated by the company are subject to periodic inspection and repair. In addition, a driver is required to report minor troubles which are immediately adjusted after the receipt of the report. In this way minor defects, ordinarily passed unnoticed by drivers of non-commercial vehicles, are repaired.

3. Weather conditions: Women as well as men operated cabs in wet and stormy weather as well as under favorable conditions.

4. Traffic conditions: Traffic conditions can be said to have been constant for the two groups. Women were not employed at night, when traffic hazards may appear to be somewhat greater than during the day. As a matter of fact, the accident rates have been found to be higher during the day than during the night, so that men may be said to have been favored in this respect. On the other hand, more serious accidents occur after dark. In addition it seems that women have "played" districts of the city in which traffic conditions are less hazardous. . . .

TABLE II

COMPARISON OF ACCIDENTS TO MEN AND WOMEN TAXICAB DRIVERS

Time	Accidents Per 1000 Miles			Accidents Per $1000 Revenue		
	Female	Male	Ratio F:M	Female	Male	Ratio F:M
1927						
March	0.336	0.251		3.02	1.49	
April	0.851	0.256		5.55	1.41	
May	0.649	0.275		4.93	1.51	
June	0.314	0.231		2.23	1.27	
July	0.608	0.226		4.43	1.41	
August	0.954	0.255		9.98	1.23	
September ..	0.911	0.248		5.01	1.43	
October	1.278	0.263		7.75	1.46	
November ..	0.857	0.250		5.04	1.41	
1928						
January ...	0.721	0.274		4.07	1.46	
February ...	0.897	0.276		5.80	1.54	
Average	0.767	0.257	2.98	5.063	1.449	3.49

An examination of Table II shows that women taxicab drivers are responsible for three times as many accidents per thousand miles as men, and three and a half times as many accidents per thousand dollars of revenue as are men.

11. *Reaction-Time Measured in Automobile Drivers*

F. A. Moss and H. H. Allen, "The Personal Equation in Automobile Driving," *Journal of the Society of Automotive Engineers*, 16: 415, 419-420 (1925)

Although many variables enter into the personal equation of the driver of an automobile, this paper concerns principally his

reaction-time. The tests described had for their objects the determining of (*a*) the average time that elapses between the hearing of a signal, such, for example, as the shot of a pistol, and the applying of the brake; (*b*) the relation between the reaction-time and the variability of the individual; and (*c*) the effect on reaction-time of such factors as the speed of driving, training, age, sex, race and general intelligence.

The reaction-time was determined by two pistols mounted on the under side of the running-board of an automobile and pointed toward the ground, the first being fired by the experimenter when the car had reached the desired speed, the second, by the person under test in making the initial motion of applying the brake-pedal. The shells used, being loaded with red lead, made bright spots on the road, the distance between which could be measured accurately. The ratio of this distance, measured in feet, to the speed of the car, in feet per second, gave the reaction-time. The subjects of the test included 36 students from George Washington University, including 10 female students; 11 colored students from Howard University; and 10 taxicab drivers. Each person was tested at speeds of 10, 15, 20, 25 and 29½ miles per hour. An average reaction-time for the total number of 285 runs was found to be 0.54 seconds. Variability was determined by subtracting the shortest reaction-time of each person from the longest and dividing the difference by two. When these results were plotted against the reaction-time of the various persons, the surprisingly high correlation factor, 0.822, was obtained.

The conclusions reached were that the reaction-time (*a*) is not appreciably affected by the speed of driving, (*b*) may be reduced by training, (*c*) is not affected by age or sex and (*d*) is related to general intelligence. The number of data at hand was insufficient to show what, if any, is the influence of race. . . .

The practical use of findings of this kind is of interest. In the licensing of automobile drivers, definite norms might be worked out giving reaction-times, the exceeding of which would prohibit an applicant from receiving a driver's license. The reasons for requirements of this kind are obvious. A person having a reaction-time of 1.5 seconds, if he were driving at the rate of 30 miles per hour, would actually go 66 feet after hearing the signal to stop. Under the present conditions of crowded traffic, the danger of having such persons on the street or road is too apparent to need further discussion. The use of these tests in determining the traffic capacity and the utility of highways is almost as important a factor as is the determination of the possible deceleration of the car itself. The fact that such relations exist, is not generally recog-

nized or appreciated. General recognition of these relations would ensure increased safety both to pedestrians and to property. It would be expected, of course, that the tests for reaction-time can be only a part of a battery of tests that would include the usual ones of performance given to automobile operators.

12. *Elimination of Accident Hazards an Engineering Problem*

W. D. KEEFER, "Training Engineers in Safety," *Twenty-Fifth Yearbook of the National Society for the Study of Education*, 320-321 (Public School Publishing Co., 1926)

The application of safety education is practically unlimited. Men, women, and children in all walks of life need to be educated to avoid accidents, but preventing accidents through the *elimination* of *accident hazards,* however, is a more complex problem, and only meager results can be expected from the great masses of our citizens. We must look to the engineer for leadership in this work, for with but few exceptions it is he, and he alone, who combines the theoretical knowledge and the practical mechanical knowledge that are both necessary for the maximum of success.

The engineer, himself, must admit that it is he who through the invention of our modern machines and appliances has created the majority of our accident hazards. To whom better, then, could we turn for the correction of these hazards than to their creator?

Even in the installation of so simple a guard as the gate for the car door of an elevator, there are engineering problems that may not be immediately apparent. There are the questions: of what material should the gate be fabricated; should it extend the whole distance of one side of the car or only part way; should it be made in one piece or more; should it be collapsible or rigid; of wood or of metal; with openings or solid; if with openings, what is the maximum sized openings to permit; how should it be fastened, and how operated, etc.

Then, too, there is the extremely important engineering problem of so designing each safeguard that it will not limit efficient operation or production. It has been demonstrated time after time that such limitation is wholly unnecessary, and that safeguards, if properly designed, installed, and operated, will actually improve operation and increase production through greater efficiency and through a feeling of greater security on the part of the user.

Revision is a problem for the engineer, even more than is safeguarding. It requires technical knowledge, not only of materials and operations, but also of entire processes. It often involves the

installation of new equipment, improving and refining existing appliances, and re-designing various processes.

C. Methods of Prevention

13. *Safety Through Education*

S. J. WILLIAMS and M. B. HILLEGAS, "Realization of the Educational Aspect of the Problem," *Twenty-Fifth Yearbook of the National Society for the Study of Education*, 15-16 (Public School Publishing Co., 1926)

In one sense, the safety movement, like any advance in human relations, is entirely educational, in that an idea is born in the mind of one man or of a few men, who then proceed to convert or 'educate' an evergrowing number of followers, until the idea gains general acceptance. Thus, industrial managers must be 'educated' to a realization of the wastefulness of accidents and the value of preventive work; engineers must be 'educated' to build only safe machines, safe buildings, and safe highways; law makers and law enforcers must be 'educated' to do their part; those responsible for the preparation of teachers must be 'educated' to train school teachers to teach safety to school children. Education in this broad sense includes much that the man in the street would term 'selling.' It is obvious that if every one in the United States were thoroughly 'sold' on safety, any present gaps in technique would be filled in short order, and most accidents would cease almost over night. But it is also true that in a much narrower sense education has come to be recognized as an essential, indeed, as the most important, part of the safety program. By 'education' in this sense is meant the systematic instruction of definite groups of persons. This includes, for example, the instruction of taxicab and truck drivers in the rules and practices of safe driving, in some sort of school conducted for this purpose by, or for, the employing companies. It covers likewise the systematic instruction of the workmen in a factory in the safe performance of their tasks, either in groups or as they pass through the employment process. It covers the instruction of the general public, as automobile drivers and as pedestrians in the facts of accident occurrence and causation, the physical conditions of vehicles and roadways, the rules of the road, and the other correct practices which safety and courtesy demand of all users of the highway. And it covers the instruction of children in the schools.

It is generally agreed to-day that accident prevention, whether in the factory, on the street, or in the home, requires a combination

of three things: mechanical safeguarding, or a safe environment; supervision, or law enforcement; and education. The last is the most important of the three and furnishes the necessary background for the other two.

14. *Practical Efficiency and Safety Tests*

C. M. Sheaffer, "Efficiency Tests of Pennsylvania Railroad Personnel," *Personnel Journal*, 3:246, 247-249 (1924); reprinted by permission of Williams & Wilkins Co.

The "tests," of which there are fourteen, relate directly to the safe operation of the railroad. On main line divisions the tests are conducted by an efficiency inspector, who has one or more assistants, together with such other members of supervisory forces, assistant train masters, assistant road foremen of engines, assistant supervisors of track and signals as may be necessary. On the smaller divisions all tests are conducted by supervisory officials.

The "observations," of which there are thirty-seven, relate to the proper observance of rules, signals and special instructions. They are made by superintendents, train masters, road foremen of engines, and other members of the superintendent's staff.

All employees whose duties are governed by signals or train rules are subject to the tests and observations. . . .

The manner in which a test is made may be illustrated by the following descriptions:

Test Number 10 (Absence of Markers).—Markers are the lights carried on the rear of trains. All trains must carry them, for they are an important safeguard as well as a means of identifying trains on the road. Their absence to a signalman in a tower observing a passing train may indicate that part of the train has broken loose. Test No. 10, therefore, concerns the engineman, the conductor, the flagman, and the signalman.

In making this test, the efficiency inspector having advised the train despatcher and other interested officials, will notify the conductor and crew of a certain train to remove their train markers between certain points, and passing certain signal towers.

One of the regular duties of a towerman is to watch passing trains for markers. If a train passes his tower without markers he must notify the superintendent immediately by wire and he must also communicate with the next signal tower. The man in the next tower is then required to give the engineman of that train, as it approaches him, a signal indicating that his train is without markers. The engineman having been notified in advance of the test simply acknowledges the signal by three blasts of his whistle

and keeps going. The train crew, also having been notified in advance, disregard the engineman's three blast whistle, and either restore the train markers or leave them off until the test is completed. If it were not a test the second towerman's signal would bring the train to a stop and the engineman's three blast whistle would notify the crew that their train was without markers. Meanwhile all those concerned with that train's movements would have been advised of the situation.

As long as the train continues without markers the same thing occurs and a steady stream of messages comes in to the superintendent's office like this: "No. 228 passed RS without markers"; "No markers on 228 passing K tower," etc. Any signalman failing to report the absence of markers on that train "fails" in an efficiency test. Any engineman failing to acknowledge the towerman's signal indicating that his train has no markers has "failed" in the test as applied to him. If the markers have been left off except under orders required in making the test, the conductor of the train has "failed" in an efficiency test. This one incident, therefore, shows how it is possible to test any number of signalmen, enginemen, conductors and flagmen, and ascertain how a number of safety precautions are observed.

15. *Mechanical Means of Accident Prevention*

W. Moede, "Unfallverhütung auf technischer Grundlage" (Technical Means of Accident Prevention), *Industrielle Psychotechnik,* 3:19-20 (1926)

All mechanical methods of combating accidents are irrational if (1) it be possible to remove the safeguards from the machine, without affecting its operation; (2) they are felt by the worker to hamper his work; (3) inadequate instruction in the automatization of hand movements is given.

The ideal technical precaution consists in rendering the machine functionless until the threatened person or member is removed from danger.

Electrical devices have been installed, so that if a machinist erects a ladder to grease the transmission, the contact shuts off the current, and a fall into the revolving gears is prevented. Similarly, cars and busses can be so regulated as to refuse to move if any one is on the steps or platform. Presses can be adjusted to require the pressure of both hands on a double lever. In cases where momentary inattention might prove fatal, it is possible to handcuff the operator which forcibly withdraws his arm when the periodically pounding press descends.

QUESTIONS

1. Why are accidents of interest to the psychologist?
2. Is it possible to discover among a group of applicants those who would be "poor risks" in dangerous situations? How is this done?
3. What are the relations between accidents and fatigue; that is, how may each be both cause and effect of the other?

CHAPTER XIV

MONOTONY

Inspection of the word *monotony* reveals its musical origin. The reference to the art of sound suggests that auditory stimuli can become disagreeable by the repetition of a unitary impression. Experience confirms this. The problem of psychology is to determine the conditions under which the "monotonous" state occurs.

The primary cause of monotony in industry seems to be the minute division of labor which is now practically universal. Unfortunately, we are forbidden to offer a simple theory of monotony because individual differences are crucial here. An intelligent observer often wastes his pity on a worker whose task seems fearfully deadening to the former but full of variety to the latter. One girl in a British factory spent a few minutes in the morning preparing her machine and materials for the day's job. After that "she married a Duke, took a trip to the Riviera, rented a mansion in West End" and had a thoroughly delightful time while she worked. Some workmen, in fact, resent being transferred to more varied tasks, claiming that they do not feel comfortable. Whether this deprivation of revery is a good or bad thing is hard to say. To some extent, it depends on the nature of the revery; that is, whether it is of pleasant or unpleasant content. Authorities view excessive introverted day-dreaming with disfavor because it is so commonly a symptom of maladjustment and predisposes to mental disorders.

Too much must not be made of those cases where workers apparently enjoy "monotonous" work. Intelligent persons suffer severely when restricted to simple repetitive tasks. A large portion of industrial labor can be performed by children or morons as well as by average adults. Consequently, for the normal man to be limited to subnormal tasks is as distasteful to him as being limited to ordinary work would be repugnant to a talented professional man.

Experimental studies are as yet too meagre or too inconclusive to be of much practical aid. One such experiment tried to segregate the persons who were susceptible to monotony by comparing their deterioration of performance in steady work on uniform tasks with the deterioration in variable operations. Those who suffered most from monotony exhibited the largest relative decrease in output. The available evidence suggests that sensitivity to uniformity may be more of an emotional than an intellectual affair.

There is no single cure for monotony, but various remedial measures may be combined. Proper vocational selection is the first step in the right direction. No able person can avoid being bored in short order with most office routine—hence, turnover is often higher among the gifted than among other groups. Second, the work can be made more interesting. Too many employees are denied a bird's-eye view of the organization, know nothing of the ultimate uses of their product, or of what goes on in the departments on the other floor. Third, alterations in the nature of the work can be instituted. Shifts of either location or activity improve job attitudes greatly, and if wisely administered should affect production positively rather than otherwise.

A. Causes of Monotony

1. *Monotony, Attention, Fatigue*

OTTO LIPMANN, "The Human Factor in Production," *Personnel Journal*, 7:94-95 (1928); reprinted by permission of Williams & Wilkins Co.

I should like to warn against characterizing the changes which have been brought about in the work of most laborers through mechanization by saying that work becomes more and more "monotonous." Monotony is not a characteristic of a job. All that we can say is that *certain* regularly repeated work processes may impress *certain* workers as monotonous. They may produce fatigue, a decrease in willingness or subjective readiness to work. Work processes which appear monotonous from the outside are by no means monotonous for many workers, since they know how to find some interesting points about the work, points which can never be detected by the outsider. Small differences in the raw material, in the way it may be handled, in the speed of the manufacturing process, etc., may be of great interest to the worker.

Even such work processes which are decidedly monotonous for a worker are for this reason not necessarily disagreeable for him. Many workmen prefer monotonous work just because they do not have to think about their work; they are able to day-dream or think about their families or matters pertaining to trade-unions, etc. Their attention is not entirely occupied by the mechanically performed work.

But this does not hold for *all* so-called monotonous work processes. It does not hold for the job of an accountant which, in spite of its monotony, requires constant attention. Still more disagreeable are those jobs in which it becomes unexpectedly necessary to react in a definite way to suddenly appearing danger signals. In order not to miss these signs of danger, the worker is forced to focus his attention *continually* on the work process which otherwise is very monotonous.

If a job occupies a worker mentally, and if it is tedious for him at the same time, the work soon suffers under the influence of fatigue; the *quantity* of the output decreases if the worker himself regulates the tempo of the work; or if he cannot regulate the tempo, the *quality* of the work suffers or accidents may occur. The attitude of the worker toward his work is therefore indicative of his fitness for this work; but I doubt very much that it is possible to determine this attitude before the worker has been on the job for a long time. It is possible finally to establish an inner contact with a certain work after it has been done for a long time; one may—for internal and external reasons—finally grow fond of it after having detested it at the beginning.

2. *The Individual a Factor in Monotony*

HUGO MUNSTERBERG, *Psychology and Industrial Efficiency*, 195-198 (Houghton Mifflin, 1913)

In an electrical factory with many thousands of employees I gained the impression that the prize for monotonous work belonged to a woman who packs incandescent lamps in tissue paper. She wraps them from morning till night, from the first day of the year to the last, and has been doing that for the last 12 years. She performs this packing process at an average rate of 13,000 lamps a day. The woman has reached about 50,000,000 times for the next lamp with one hand and with the other to the little pile of tissue papers and then performed the packing. Each lamp demands about 20 finger movements. As long as I watched her, she was able to pack 25 lamps in 42 seconds, and only a few times did she need as many as 44 seconds. Every 25 lamps filled a box, and the

closing of the box required a short time for itself. She evidently took pleasure in expressing herself fully about her occupation. She assured me that she found the work really interesting, and that she constantly felt an inner tension, thinking how many boxes she would be able to fill before the next pause. Above all, she told me that there is continuous variation. Sometimes she grasps the lamp or paper in a different way, sometimes the packing itself does not run smoothly, sometimes she feels fresher, sometimes less in the mood for the work, and there is always something to observe and something to think about.

This was the trend which I usually found. In some large machine works I sought for a long time before I found the type of labor which seemed to me the most monotonous. I finally settled on a man who was feeding an automatic machine which was cutting holes in metal strips and who simply had to push the strips slowly forward; only when the strip did not reach exactly the right place, he could stop the automatic machine by a lever. He made about 34,000 uniform movements daily and had been doing that for the past 14 years. But he gave me the same account, that the work was interesting and stimulating, while he himself made the impression of an intelligent workingman. At the beginning, he reported, the work had sometimes been quite fatiguing, but later he began to like it more and more. I imagined that this meant that at first he had to do the work with full attention and that the complex movement had slowly become automatic, allowing him to perform it like a reflex movement and to turn his thought to other things. But he explained to me in full detail that this was not the case, that he still feels obliged to devote his thoughts entirely to the work at hand, and that he is able only under these conditions to bring in the daily wage which he needs for his family, as he is paid for every thousand holes. But he added especially that it is not only the wage which satisfied him, but that he takes decided pleasure in the activity itself.

On the other hand, I not seldom found wage earners, both men and women who seemed to have really interesting and varied activities and who nevertheless complained bitterly over the monotonous, tiresome factory labor. I became more and more convinced that the feeling of monotony depends much less upon the particular kind of work than upon the special disposition of the individual. It cannot be denied that the same contrast exists in the higher classes of work. We find school-teachers who constantly explain that it is intolerably monotonous to go on teaching immature children the rudiments of knowledge, while other teachers with exactly

the same task before them are daily inspired anew by the manifoldness of life in the classroom.

3. *Boredom in Work*

S. Wyatt, J. A. Fraser and F. G. L. Stock, *The Effects of Monotony in Work*, Report No. 56 of the Industrial Fatigue Research Board, 2-7 (His Majesty's Stationery Office, London, 1929)

Nature of Boredom.—A consideration of the nature of boredom may be conveniently approached by contrasting it with interest, since one is due to the absence of certain elements which are present in the other. Activities are usually interesting when they appeal to one or more of the fundamental instinctive tendencies, or to some acquired disposition based upon these tendencies. The curiosity displayed by a youth in the working of a machine and the interest of the speculator in the stock exchange, are examples. To be interested means that we attend spontaneously to the object or situation which appeals to our inclination or desires, and we continue to do so until either satisfaction is achieved or the tendency is neutralized by the effects of fatigue. A characteristic feature of interesting activities is that they are performed with a minimum of effort. The curve of work obtained under such conditions usually exhibits a high level of performance and only begins to decline as the effects of fatigue increase.

Conversely, activities that fail to harmonize with the desires of the individual or make no appeal to the instinctive tendencies are usually uninteresting and unsatisfying. The natural inclination of all individuals is to discontinue activities which are unpleasant, so that if this is impossible they are only continued at the expense of increased volitional effort. In such cases, effort is not only required to perform the necessary movements; it must also be used to repress the intruding ideas and desires. Thus, work under such conditions may very quickly become distasteful and unsatisfying, and the resulting experience is known as boredom.

It is obvious that boredom, at least in its early stages, is something quite distinct from fatigue. An audience may be intensely bored by a lecture, but as a rule it is far from being fatigued. Continued exposure to such conditions may, of course, lead eventually to a certain amount of weariness, but a sudden change in the proceedings will speedily reawaken interest, and restore the enthusiasm which had gradually faded away. Boredom, therefore, is a psychical state which may exist quite apart from fatigue, and must be separately considered in any industrial inquiry dealing with factors which impair production.

The nature of boredom has been the subject of several theoretical and experimental contributions to psychological literature, and a brief reference to the more important publications will indicate the lines along which inquiries have proceeded.

One of the earlier writers, Rumelin, stated that the continuance of work involved the enforced expenditure of effort, together with the repression of distracting stimuli arising from the activity of unfatigued mechanisms and natural impulses. As a result, dissatisfaction was said to be caused not only by the thwarting of natural inclinations, but also by the repeated inhibitions of contrary desires and tendencies.

Von Schubert-Soldern approached the question by comparing the nature of the movements involved in work and in play. He pointed out that the manipulative activities of the industrial operative are restricted and controlled by the conditions of work and lack the freedom and variety of those expressed in play. In play movements are said to be spontaneous and satisfying; in work the movements are not pleasant in themselves, but require effort for their continuance.

A somewhat different view has been taken by other writers who have attempted to determine the nature of the reaction to repeated stimuli of a uniform and varied kind. Ranschburg, for instance, found that the apprehension and reproduction of the separate components of a uniformly repeated series was more difficult than in a varied series. Münsterberg also, as the result of a number of laboratory experiments, put forward the view that individuals differ in their reception of uniformly repeated stimuli. In some subjects each repetition was facilitated by the one which preceded it, and performance was said to be comparatively free from effort and accompanied by satisfaction. In others, the reception of each impression inhibited the reaction to the next in the series, and the subjects were obliged to attend to each in turn. The effort involved created a feeling of displeasure, and the conditions were said to be monotonous. Thus boredom appears to be associated with difficulty in the reception of uniformly repeated stimuli, and is most marked in those individuals who are compelled to attend to each successive impression.

Winkler, continuing this line of investigation, came to the conclusion that individuals who suffer from boredom are those who find it necessary to give some, but not the whole, of their attention to work. He found that several of his subjects maintained a fairly uniform rate of working, and these, with one exception, stated that the work was pleasant. Either they were able to work automatically, in which case their thoughts were, as a rule, wholly

detached from the process, or they were wholly concentrated on the task and found satisfaction in the recurring homogeneous impressions. The remainder showed an initial improvement in their rate of working, followed by great variations, during which they displayed many signs of boredom such as restlessness, yawning, looking at the clock and the like. Those symptoms, which occurred after work had been in progress for about an hour, were attributed by Winkler to a psychological "stirring-up" originating from a revulsion of feeling caused by the aimless and tedious nature of the work. . . .

The foregoing hypotheses have been derived chiefly from the results of laboratory experiments, since observations on the nature of boredom in industry have as yet been incidental to other inquiries. The present report is an attempt to remedy this deficiency, and although preliminary in nature, may yet indicate lines for future research. . . .

The complete report includes a description of the procedures followed in obtaining introspective evidence of boredom and objective data of minute variations in each girl's rate of working. Work processes investigated were winding filaments for incandescent lamps, soap wrapping, chocolate packing, and tobacco weighing.

Summary.—The results obtained in this investigation may be summarized as follows:

(1) The experience of boredom is fairly prevalent among operatives employed on repetitive processes of the type considered in this report. Of the 49 operatives concerned in this inquiry, only 13, or 26.5 per cent, were able to state that boredom was seldom or never experienced.

(2) Boredom causes a reduced rate of working which is particularly noticeable about the middle of the spell. This decrease usually lasts from one to two hours, and during that time the average reduction in the rate of working varies from 5 to 10 per cent. It is followed by a steadier and improved rate of working as the end of the spell is approached.

The lower rate of working sometimes observed in the morning spell of work, especially when the operatives were paid on a time-rate basis, is also an indication of boredom.

(3) Boredom also causes a more variable rate of working which is characterised by rapid fluctuations in the time taken to complete consecutive units of output. As a general rule a reduced rate of working is accompanied by increased variability.

(4) Boredom is also responsible for an over-estimation of time intervals and a consequent apparent increase in the length of the

working day. This over-estimation appears to be associated with a slower rate of working.

(5) The amount of boredom experienced bears some relation to the degree of mechanisation of the task. It is less liable to occur when (*a*) the work is entirely automatic. In such cases thought can be detached from work and directed to more interesting subjects, or utilised in conversation with other workers. If, however, the mind is not distracted in this manner, boredom can be very intense; (*b*) when attention is entirely concentrated on the task. In such cases unexpected and varied situations frequently arise and the operative has no time to dwell on unpleasant features associated with the conditions of work.

It is most marked in semi-automatic processes which require enough attention to prevent mind-wandering but not enough for the complete absorption of mental activity.

(6) The experience of boredom is largely dependent upon individual characteristics and tendencies. In particular, workers of superior intelligence seem to be bored by repetitive work. The more intelligent operatives are, however, usually above the average in productive efficiency, while the less intelligent workers tend to be below the average in this respect.

Individual differences in ability to mechanise a task, and consequently in ability to detach themselves from work, are also very marked.

Temperamental tendencies are important determinants of boredom, and need special investigation.

(7) The amount of boredom experienced bears some relation to the conditions of work. It is less liable to arise (*a*) when the form of activity is changed at suitable times within the spell of work, (*b*) when the operatives are paid according to output produced instead of time worked, (*c*) when the work is conceived as a series of self-contained tasks rather than as an indefinite and apparently interminable activity, (*d*) when the operatives are allowed to work in compact social groups rather than as isolated units, and (*e*) when suitable rests are introduced within the spell of work.

(8) Continued exposure to monotonous conditions of work causes adaptation to such conditions so that work which initially is tedious and unpleasant may afterwards be tolerated or even mildly enjoyed.

4. *A Theory of Monotony*

A. T. Poffenberger, *Applied Psychology*, 221-222 (Appleton, 1927)

It seems possible, without creating any distinctly new theory of monotony, to relate it to the phenomena of distraction. We have

said that a waking person is always attending to something and that there is a natural tendency for attention to fluctuate or flit about from one object to another. Whether this phenomenon of fluctuation is due to temporary blocking of the conducting mechanisms within the central nervous system, or whether it is evidence of a kind of refractory phase of parts of the central nervous system analogous to that in heart action and parts of the spinal cord, is not known. It is tiring or fatiguing to resist this tendency to fluctuate. It implies an inhibitory process which is not a purely subjective phenomenon, but is a struggle between motor mechanisms for the control and direction of behavior. When the movements of attention are artificially restricted by the devices of the hypnotist, the patient will fall asleep. When not under such artificial control, constant attention of a limited sort is boresome, wearisome, monotonous. Innumerable objects are competing for the attention. Some of them we call distractions if, for any reason, they are not appropriate objects of attention. Resistance to such distractions, whether they are lights, sounds, odors, contacts or what not, means the expenditure of effort.

The competition for attention which occurs under ordinary circumstances is between what one *wants* to attend to and what he *needs* to attend to. The wants must be inhibited in favor of the needs. To maintain attention upon a routine task when the mind is drawn toward pleasing objects, memories and imaginations means the expenditure of effort and is fatiguing. Where the need is great, as in tending a rapidly revolving and dangerous machine so that fluctuations of attention might mean an accident, the inhibition of the distractions soon becomes wearisome. The task has become monotonous. On the other hand, where needs and desires coincide exactly, monotony should be entirely absent. According to this interpretation, resisting the distraction of a bright light when reading should give the same sort of irritation, restlessness and weariness that results from resisting pleasing memories or other powerful competitors for attention while working. Such seems to be the case. Monotony might, therefore, be called a manifestation of fatigue of the attention mechanism which results from resisting a particular class of distractions.

5. *A Theory of the Division of Labour*

ADAM SMITH, *An Inquiry into the Nature and Causes of the Wealth of Nations*, 14-17 (Oxford University Press, 1869)

This division of labour, from which so many advantages are derived, is not originally the effect of any human wisdom, which

foresees and intends that general opulence to which it gives occasion. It is the necessary, though very slow and gradual consequence of a certain propensity in human nature which has in view no such extensive utility; the propensity to truck, barter, and exchange one thing for another.

Whether this propensity be one of those original principles in human nature, of which no further account can be given; or whether, as seems more probable, it be the necessary consequence of the faculties of reason and speech, it belongs not to our present subject to inquire. It is common to all men, and to be found in no other race of animals, which seem to know neither this nor any other species of contracts. Two greyhounds, in running down the same hare, have sometimes the appearance of acting in some sort of concert. Each turns her towards his companion, or endeavours to intercept her when his companion turns her towards himself. This, however, is not the effect of any contract, but of the accidental concurrence of their passions in the same object at that particular time. Nobody ever saw a dog make a fair and deliberate exchange of one bone for another with another dog. Nobody ever saw one animal by its gestures and natural cries signify to another, This is mine, that yours; I am willing to give this for that. When an animal wants to obtain something either of a man or of another animal, it has no other means of persuasion but to gain the favour of those whose service it requires. A puppy fawns upon its dam, and a spaniel endeavours by a thousand attractions to engage the attention of its master who is at dinner, when it wants to be fed by him. Man sometimes uses the same arts with his brethren, and when he has no other means of engaging them to act according to his inclinations, endeavours by every servile and fawning attention to obtain their good-will. He has not time, however, to do this upon every occasion. In civilized society he stands at all times in need of the coöperation and assistance of great multitudes, while his whole life is scarce sufficient to gain the friendship of a few persons. In almost every other race of animals each individual, when it is grown up to maturity, is entirely independent, and in its natural state has occasion for the assistance of no other living creature. But man has almost constant occasion for the help of his brethren, and it is vain for him to expect it from their benevolence only. He will be more likely to prevail if he can interest their self-love in his favour, and show them that it is for their own advantage to do for him what he requires of them. Whoever offers to another a bargain of any kind, proposes to do this: Give me that which I want, and you shall have this which you want, is the meaning of every such offer; and it is in this

manner that we obtain from one another the far greater part of those good offices which we stand in need of. It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own interest. We address ourselves, not to their humanity but to their self-love, and never talk to them of our own necessities but of their advantages. Nobody but a beggar chooses to depend chiefly upon the benevolence of his fellow-citizens. Even a beggar does not depend upon it entirely. The charity of well-disposed people, indeed, supplies him with the whole fund of his subsistence. But though this principle ultimately provides him with all the necessaries of life which he has occasion for, it neither does nor can provide him with them as he has occasion for them. The greater part of his occasional wants are supplied in the same manner as those of other people, by treaty, by barter, and by purchase. With the money which one man gives him he purchases food. The old clothes which another bestows upon him he exchanges for other old clothes which suit him better, or for lodging, or for food, or for money, with which he can buy either food, clothes, or lodging, as he has occasion.

As it is by treaty, by barter, and by purchase, that we obtain from one another the greater part of those mutual good offices which we stand in need of, so it is this same trucking disposition which originally gives occasion to the division of labour. In a tribe of hunters or shepherds a particular person makes bows and arrows, for example, with more readiness and dexterity than any other. He frequently exchanges them for cattle or for venison with his companions; and he finds at last that he can in this manner get more cattle and venison than if he himself went to the field to catch them. From a regard to his own interest, therefore, the making of bows and arrows grows to be his chief business, and he becomes a sort of armourer. Another excels in making the frames and covers of their little huts or movable houses. He is accustomed to be of use in this way to his neighbours, who reward him in the same manner with cattle and with venison, till at last he finds it his interest to dedicate himself entirely to this employment, and to become a sort of house-carpenter. In the same manner a third becomes a smith or a brazier; a fourth a tanner or dresser of hides or skins, the principal part of the clothing of savages. And thus the certainty of being able to exchange all that surplus part of the produce of his own labour, which is over and above his own consumption, for such parts of the produce of other men's labour as he may have occasion for, encourages every man to apply himself to a particular occupation, and to cultivate and bring to perfection

whatever talent or genius he may possess for that particular species of business.

The difference of natural talents in different men is, in reality, much less than we are aware of; and the very different genius which appears to distinguish men of different professions, when grown up to maturity, is not upon many occasions so much the cause as the effect of the division of labour. The difference between the most dissimilar characters, between a philosopher and a common street porter, for example, seems to arise not so much from nature, as from habit, custom, and education. When they came into the world, and for the first six or eight years of their existence, they were, perhaps, very much alike, and neither their parents nor play-fellows could perceive any remarkable difference. About that age, or soon after, they come to be employed in very different occupations. The difference of talent comes then to be taken notice of, and widens by degrees, till at last the vanity of the philosopher is willing to acknowledge scarce any resemblance. But without the disposition to truck, barter, and exchange, every man must have procured to himself every necessary and conveniency of life which he wanted. All must have had the same duties to perform, and the same work to do, and there could have been no such difference of employment as could alone give occasion to any great difference of talents.

As it is this disposition which forms that difference of talents, so remarkable among men of different professions, so it is this same disposition which renders that difference useful. Many tribes of animals, acknowledged to be all of the same species, derive from nature a much more remarkable distinction of genius, than what, antecedent to custom and education, appears to take place among men. By nature a philosopher is not in genius and disposition half so different from a street porter, as a mastiff is from a greyhound, or a greyhound from a spaniel, or this last from a shepherd's dog. Those different tribes of animals, however, though all of the same species, are of scarce any use to one another. The strength of the mastiff is not in the least supported either by the swiftness of the greyhound, or by the sagacity of the spaniel, or by the docility of the shepherd's dog. The effects of those different geniuses and talents, for want of the power of disposition to barter and exchange, cannot be brought into a common stock and do not in the least contribute to the better accommodation and conveniency of the species. Each animal is still obliged to support and defend itself, separately and independently, and derives no sort of advantage from that variety of talents with which nature has distinguished its fellows. Among men, on the contrary, the most

dissimilar geniuses are of use to one another; the different produces of their respective talents, by the general disposition to truck, barter, and exchange, being brought, as it were, into a common stock, where every man may purchase whatever part of the produce of other men's talents he has occasion for.

6. *The Limits of Labor Division*

J. R. COMMONS, "Labor Conditions in Meat Packing and the Recent Strike," *Quarterly Journal of Economics*, 19:3-4 (1904)

The proportion of skilled workmen in the butchers' gang is very small, owing to a minute division of labor. It would be difficult to find another industry where division of labor has been so ingeniously and microscopically worked out. The animal has been surveyed and laid off like a map; and the men have been classified in over thirty specialties and twenty rates of pay, from 16 cents to 50 cents an hour. The 50-cent man is restricted to using the knife on the most delicate parts of the hide (floorman) or to using the axe in splitting the backbone (splitter); and, wherever a less skilled man can be slipped in at 18 cents, 18½ cents, 20 cents, 21 cents, 22½ cents, 24 cents, 25 cents, and so on, a place is made for him, and an occupation mapped out. On working on the hide alone there are nine positions, at eight different rates of pay. A 20-cent man pulls off the tail, a 22½-cent man pounds off another part where the hide separates readily, and the knife of the 40-cent man cuts a different texture and has a different "feel" from that of the 50-cent man. Skill has become specialized to fit the anatomy.

B. Effects of Monotony

7. *Motor versus Mental Stereotypes*

FRANK WATTS, *Introduction to the Psychological Problems of Industry*, 119 (Allen & Unwin, Ltd., London, 1921)

The psychological dilemma concerning the monotony of repetition-process work is this: either the worker employs all his powers on the task, in which case there is established an undesirable limitation and stereotyping of mental process so that the movements of his mind tend to become unduly circumscribed and uniform, *and this is bad for the worker;* or the mechanical processes tend to be carried on automatically while the conscious attention is given to other things, which means that only a small portion of the worker's energy is given to the work, and *this is frequently bad for his employer.*

8. *Interest versus Incentives*

H. MAROT, *Creative Impulse in Industry*, 44-46 (Dutton, 1918)

Factory management like college and school management, instead of depending on the subject matter to interest the workers, instead of opening up to them the factors of interest in industrial enterprise, has adopted incentives for getting the required work done. Enlightened school practice, out of long failure to get the children's initiative by the artificial stimulus of rewards for work done, now depends upon the content of the subject matter and the children's experiments with it, to develop their desire to do the work. The practice of depending on school rewards instead of interest in subject matter is largely responsible for superficial knowledge and lack of ability to think as well as to act. As schools fail to incite the interest of the children they train them to put through this and that task and reward them for it without having added to their power of undertaking tasks on their own account. Indeed, as they fail to give them the chance to do that, they actually decrease whatever power they may have had.

The doing of tasks in factories for the sake of rewards, gives the workers experience in winning rewards. As they are interested only in the reward, they carry away no desire or interest in the work experience. As the method of doing the work is prescribed in every detail and their only requirement, under scientific management, is to follow directions with accuracy, they are trained to do their tasks as the children in school are trained. They are trained in routine, and to do each task as it is given. This is not education, it is training to do tricks. The worker does not take over what can be called experience from one task to another. He forms certain motor habits called skill. But under the efficient methods of scientific management the acquirement of this skill is robbed even of the educational value that is had under the unscientific method of factory work, which within its limited field, left the worker to discover by trial and error what were the best methods of getting results. Moreover, the standards of workmanship which scientific management sets up are not the worker's own standards; he has had no part in the making of them or in deciding on the comparative merits of the results. He accomplishes the results as he follows directions, not for the sake of the result, not for the sake of good workmanship, but for the reward.

9. *The Anatomy of Machinery*

S. Chase, *Men and Machines*, 22-24, 116-117 (The Macmillan Co., 1929)

The learned professors have been at considerable pains in their attempts to make a distinction between tools and implements on the one hand, and machinery on the other. Nor have they arrived much of anywhere. The one is continually shading into the other. Here is an ordinary shovel used by a day laborer in a ditch; here is the same shovel with a somewhat thicker handle, containing a pneumatic attachment which is said to improve its digging power; here is a very much larger shovel with curved ends and steel teeth, hitched to an arm that is hitched to a steam engine, which can gobble up a cartload of dirt at one mouthful. Where does the tool stop and the machine begin? A grindstone is widely held to be a primitive tool; a turret lathe is widely held to be a machine. Both spin around. What is the essential difference? The employment of non-human power, steam, oil, gas, has been defined as the difference. Well and good. Then everything worked by human hands and legs is a tool only, and bicycles, typewriters, adding machines, sewing machines, foot lathes, clocks, hand-pumps—are not machines. Which is absurd. And what is one to do with treadmills for grinding corn, whose motive power is said by some to be the donkey, and by some the carrot in front of his nose?

Certain anthropologies hold that man, having discovered tools, ceased to evolve biologically. Animals, never having discovered them, continue to fashion drills out of their beaks, oars out of their hind feet, wings out of their forefeet, suits of armour out of their hides, levers out of their horns, saws out of their teeth. Whether this be true or not, all authorities agree that man is *the* tool-using animal. It sets him off from the rest of the animal kingdom as drastically as does speech. If tools are machines, machinery has been in our inheritance for at least one hundred thousand years, and if this school of anthropology is correct, we have become biologically adapted to the tool-machine. . . .

The fact of operating a powerful machine with full responsibility for its control, far from being a monotonous, depressing, soul-destroying job, is, as a rule, precisely the opposite. It tends to expand the ego, establish self-confidence, break down inhibitions, keep one out of a rut. One needs no further proof than the health records, both mental and physical, of locomotive engineers as a group. A finer, more courageous, better-balanced body of men is not to be found in this or any other civilization. Indeed no more proof is needed than one's own reactions to driving a motor car, if the runs are not interminably long or overcomplicated.

The same applies, but with diminished force, to the operation of machines whose movements are limited. Here control is not complete, but responsibility for a powerful monster is still marked. The builder of the Mohawk Trail told me that every man who came on the job wanted to run a pneumatic rock drill—to the observer a dusty, noisy, devilish device. Engineers on steamships, skilled machinists, are not normally broken and ailing men, but the reverse. The case is far more dubious with elevator operators.

When we descend to plain machine-tending, however, the story changes—particularly when the machine sets a remorseless rhythm to which the worker must adapt himself. Without responsibility, without the possibility of letting something of the power of the machine into one's own veins, the process has the chance of becoming very monotonous, fatiguing, and even mentally dangerous, while the chances for physical accidents markedly increase.

In respect to inventing, inspecting and repairing machines we have a skilled, often a very highly skilled occupation, where routine tends to be at a minimum, and one's creative or observing faculties at a maximum. It is replete with change of pace, and in many cases is as exciting as controlling a motor bus or a locomotive.

10. *Factors Affecting Work Attendance*

C. J. Ho, "Which Workers Have Good Attendance?" *Personnel Journal*, 7:385-386 (1929); reprinted by permission of Williams & Wilkins Co.

Two hundred employees of R. H. Macy & Company were taken as cases for study. They represent various kinds of jobs in selling and non-selling departments. Their records were taken at random from the files, so they constitute an entirely unselected group.

The object of this study was to find the extent to which sex, age, marital status, personality difficulties, and home problems were causes of lateness and absentism in a department store. The results show that the average number of lates per month for the youngest is 0.89, and for the oldest is 0.23; that the average number of absences per month for the youngest is 0.55, and the oldest is 0.18; that the average number of sick benefits per month for the youngest is 0.08, and for the oldest is 0.19.

The average number of lates per month for married people is 0.24; for single, 0.65; for widowed, 1.15. The average number of absences per month for married people is 0.32; for single, 0.47; for widowed, 0.94.

Those who have no personality difficulties show 0.46 average number of lates per month; those with difficulties of one form or

another show 0.63. The average number of absences per month for those with no difficulties is 0.45; for those with some difficulty is 0.51.

Those with no home problems average 0.46 lates per month; those with some problems 0.69. The average number of sick benefits per month is 0.14 for those with no home problems; and 0.31 for those with some.

When sex differences are taken into consideration, the results show that women who have home problems have more lates, absences, and sick benefits than those who are without them. But with men, home problems seem to have a tendency to make them more careful about attendance. In general, women are more frequently late and absent, but have fewer sick absences of long duration, than men.

C. Suggested Remedies

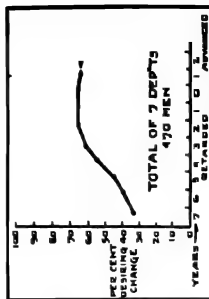
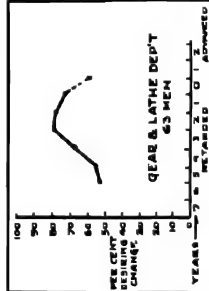
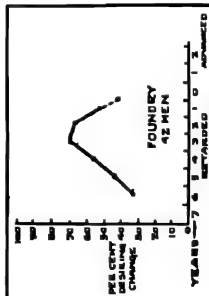
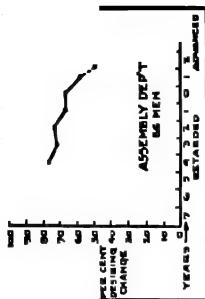
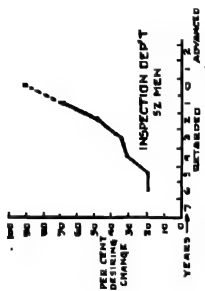
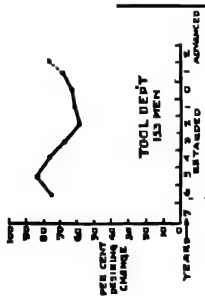
11. *Mental Alertness and Stability*

W. D. Scott and M. H. S. Hayes, *Science and Common Sense in Working with Men*, 72-77 (Ronald Press, 1921)

It seems almost childish to comment on the value to an industrial organization of stability in its working force. After you have selected your worker, after you have placed him and trained him, the great desire is naturally to keep him.

What assistance can we obtain on the problem of stability by studying the mental ability of the workers? Mental alertness appears as a factor in stability because maladjustments result when men are put on jobs they are incapable of doing, and because the wrong balance between intelligence and job responsibility produces dissatisfaction, instability, and desire for change of work. We quote now from a report made for departments of a manufacturing company. The 470 employees included in the investigation were asked whether they were satisfied with their present jobs or whether they desired change of work. This information was then brought into relation with the number of years each man was retarded at the time he left public school, this being the one available indication of mental alertness.

The proportion of workers of each degree of retardation desiring change of work is shown, for five departments, in the accompanying charts.

The differences found in passing from one department to another are striking. In the tool department work is high grade and varied. A worker, to be successful, must make many independent decisions

DESIRE FOR CHANGE OF JOB AND STATUS AT LEAVING PUBLIC SCHOOL

in doing his work. Here the greatest proportion of dissatisfaction occurs among the workers who were most retarded in school. The stability increases as amount of retardation lessens, and then decreases slightly among those who made normal, or better than normal, progress in school. Clearly those who are more than four years retarded are more likely to be dissatisfied with tool department work than the group less than two years retarded.

By contrast with the work of the tool department, the work of the inspection department is largely "fool-proof," repetitive, and monotonous. (In this particular industry it consisted simply in passing crude castings through a set gauge and throwing aside those that were too large.) Here the amount of dissatisfaction is low for those men who were very retarded in school. The percentage of dissatisfaction increases markedly, until, for those men whose progress in school was normal, 90 per cent expressed a wish for some other kind of work.

It is a significant fact that in the inspection department there were found both the highest percentage of satisfaction and the highest percentage of dissatisfaction. This means that in this department there is opportunity, through the right adjustment of mental ability to the job, to secure the highest stability; and there is also danger, through maladjustment, of producing the greatest instability. From the point of view of job-satisfaction, this single occupation is both the best and worst in the plant—based on a consideration of the mental alertness of the applicant.

In both the foundry and the gear and lathe departments, the men who are most retarded are the most satisfied with their work; the men who are least retarded are almost equally content. The greatest instability is found among those who occupy a middle ground in the matter of retardation. This curious fact may be understood when it is realized that in these two departments there are both very low-grade and very high-grade jobs. Low-grade workers on low-grade jobs, e.g., chipping and cleaning, are satisfied, and they are incapable of the high-grade work. High-grade workers on high-grade jobs, e.g., moulding and gear-cutting, are satisfied, and they refuse the low-grade work. The result is that in these departments the low-grade and high-grade men gradually gravitate to the type of work for which they are fitted. Men of middle grade, however, find the low-grade work dull and uninteresting; the high-grade work is beyond their capacity. Consequently, it is in this group that misplacement is most common and desire for change of work is most pronounced.

12. *Variety and Uniformity in Work*

S. **Wyatt**, J. A. **Fraser**, and F. G. L. **Stock**. *The Comparative Effects of Variety and Uniformity in Work*, Report No. 52 of the Industrial Fatigue Research Board, 2-3, 22-25 (His Majesty's Stationery Office, London, 1928)

Previous investigations have shown that, in certain forms of repetitive handwork, the rate of working cannot be maintained at a consistently high level during an unbroken spell of four or five hours, but is retarded and increases in variability about the middle or towards the end of the spell, whilst at the same time voluntary stoppages tend to become more numerous. These features of the work curve have been attributed partly to the inhibiting effects of boredom and fatigue, and partly to the uniformity in posture maintained during work, and have led to the conception that the introduction of short authorized rests or of changes in the form of activity at suitable times within the spell of work, would tend to neutralise most of the objectionable effects, and, by conserving the energy of the operatives give rise to increased output and greater personal satisfaction.

Rest-pauses have already been the subject of several investigations and the results obtained have usually confirmed these expectations. The possibilities connected with the introduction of changes in activity have, however, received little attention. . . .

Procedure Adopted.—A preliminary survey of repetitive conditions in industry showed that in some processes, the operatives were sometimes employed in varied forms of work, while on other occasions the same form of activity was continued throughout the day. Accordingly it seemed advisable to begin the enquiry by a general consideration of existing conditions, whenever these offered facilities for comparing the effects of variety and of uniformity respectively. . . .

[Preliminary investigations were made of occupations that were essentially repetitive but involved some varied forms of work. These were soap wrapping, handkerchief folding, and bicycle chain assembling. Then in a more intensive study, an attempt was made to determine the optimum duration of activity for particular kinds of work.]

Discussion of Results.—Subject to the limitations imposed by the small number of workers observed in each group and the limited facilities for investigation, the results show that when the form of work is changed at specified times within the spell, output is usually increased and a steadier rate of working maintained.

The beneficial effects appear to depend upon certain elements in the conditions of work, viz.:

(1) The nature of the alternating activities
(2) The frequency of the change periods
(3) The type of work

Nature of the Alternating Periods.—The most favourable results produced by changing the form of work were obtained in the bicycle-chain process, tobacco-weighing, and cigarette-making. In each of these operations the alternating form of activity involved a change from one form of work to something very different; it seems highly probable that the dissimilarity between the alternating processes was largely responsible for the increased output observed on the days of varied work. In the handkerchief folding process, although the form of work was changed at approximately hourly intervals, there was no appreciable difference between the results obtained under the uniform and varied conditions of work, and the similarity in question was probably due to the high degree of resemblance in the essential movements (folding and smoothing) involved. At the same time the opinions of the operatives suggested that the varied activities were more satisfying than the results indicate, since they were unanimous and emphatic in their preference for the varied method of folding. In general, therefore, it appears that the extent of the difference involved in changing from one form of activity to another may be a factor of considerable importance.

Frequency of the Change Period.—Generally speaking, the most favourable results provided by the present investigation were obtained when changes in the form of activity were introduced after work had been in progress for 1½ or 2 hours. In the soap-wrapping process, however, although the successive operations on the varied days were widely different from each other and involved numerous changes in posture, the output was lower than on the days of uniform procedure. The longest time devoted to any single continuous operation under the varied conditions of work was never greater than 15 minutes, while in many cases only a few seconds elapsed before a change occurred. Under such conditions the swing of work was frequently interrupted, and the maximum rate of working seldom obtained.

The unfavourable effects of too many changes in the form of activity observed in this instance are similar to those noted in a previous report. A somewhat similar explanation would also account for the slower rate of working observed when stacking the smaller trays in the cartridge assembling operation.

It seems reasonable to infer, therefore, that changes in the form of work must not be too numerous if a high degree of efficiency is desired. . . .

The foregoing considerations appear to harmonise with the hypothesis that fatigue produced by light repetitive work is more local than general. A suitable change in the form of activity seems to utilise comparatively unused parts of the body mechanism, thereby providing a situation which is favourable to productive activity. It would accordingly appear that if the most satisfactory results are to be obtained, a muscular process, for instance, should preferably be followed by one which is predominantly mental, or an operation involving standing by one involving sitting. In most industrial departments there are operations of a widely different nature which might be organised so as to provide the workers with a certain amount of variety of occupation.

Continuous unvaried activity is also conducive to boredom, which is usually most marked and causes a reduction in output about the middle of the work-spell. Changes in the form of activity tend to neutralise or retard the onset of boredom, and the steadier rate of working observed under such conditions is partly attributable to a diminution in the amount of boredom experienced.

Changes in the form of work also tend to produce an increased rate of working in the early stages of the work-spell. The anticipated change seems to create a more buoyant attitude towards the task, and diminishes the inhibitory effects produced by the prospect of an unbroken spell of uniform work.

In addition to the possibilities and advantages already discussed, the adoption of suitable changes in the form of work will be found particularly serviceable when increased output is temporarily required in any department or when the staff is depleted by absenteeism. In such cases it would be possible to draw upon experienced workers from other departments and thereby avoid loss of trade or dislocation of work. Such a procedure would necessarily require the learning of two or more operations by each operative, but the disadvantages attendant upon such a policy would be more than balanced by the benefits derived.

It is frequently asserted that operatives accustomed to uniformity in the methods and conditions of work are reluctant to change to a more varied form of procedure. This attitude is merely another illustration of the inertia produced by long-established habit and the desire to live along the lines of least resistance. There is little doubt that operatives who have had experience of both uniform and varied conditions of work, generally prefer the latter and the results obtained in this enquiry support this view.

Summary of Conclusions.—The results of the investigations considered in this report indicate that, in the case of light repetitive work—

(1) Uniformity in the method of procedure is generally less productive and conducive to greater irregularities in the rate of working than are varied forms of work.
(2) The highest output is obtained when the form of activity is changed after 1½ or 2 hours of unvaried work.
(3) Many changes are detrimental to output because of their interference with the swing of work.

In addition, there is a certain amount of evidence to show that

(4) In repetitive work of a fatiguing nature, changes in the form of activity should be relatively more frequent.
(5) A high degree of resemblance between the alternating forms of activity, although subjectively satisfying, is not conducive to increased output.

QUESTIONS

1. Does monotony always result from constantly doing an unvaried operation? If not, what are some other likely causes?
2. Can you name any innate tendencies which might be responsible for the origin and maintenance of the policy of the division of labor? Defend your answer. Criticize the theory of Adam Smith.
3. Describe in detail how absenteeism, lateness, and excessive turnover serve as indicators of the monotonous character of a specific job.

CHAPTER XV

MORALE: MOTIVATION AND SATISFACTION IN WORK

Although the word *morale* lacks the precision of most scientific terms, it refers to one of the leading facts in personal and social experience. Being of French origin, it is not surprising that a similar idea should be expressed by the Gallicism *esprit de corps*. Both phrases are employed interchangeably in the positive sense to suggest the presence of zest in action, enthusiastic good fellowship, coöperativeness, etc. In the military and athletic senses, it implies all the preceding elements plus an irrational conviction that one side will inevitably win and that its cause is holier than the others.

Like every other psychic variable, morale may show quantitative fluctuations from a maximum of devoted team-work to a minimum of hopeless depression and unwillingness to do anything. It is an extraordinarily complex mental state resulting from the convergence of numerous lines of influence. "High" morale may be induced and maintained by knowledge that one is employed in the best equipped shop in town, that one is relatively better paid than others even though the wage differential may be but a fraction of a cent, that not every mechanic can do the job as well as one is performing it, etc. Conversely, "low" morale may be traced to awareness that one is in a "blind-alley" post, that any fool could do the work as well if not better than one's self, that the occupation one is pursuing is disparaged rather than esteemed socially, etc. Superficial thinkers often allege that all that is needed to boost morale is to inaugurate a 10 per cent wage increase, forgetful of the fact that in any organization with persistent poor morale there may be a thousand things wrong with the nature of the work, the condition of the surroundings, and the policies of the management.

It is probably fanciful to hope that morale can always be kept at a high pinnacle. Everyday experience indicates that even stable personalities exhibit "ups and downs" in emotional

fervor, and physiological psychology confirms this when it stresses the effects of cyclical glandular changes, periodic neural impulsions, oscillations in muscular tone, etc. However, just as prolonged depression symptomizes some grave physical or mental disorder, so a constant lack of morale betokens a highly inefficient organization. Competent leadership will see in morale its best index of industrial health, and aim steadily to preserve it at a high plane.

To the psychologist, morale is reducible to the two factors of motivation and satisfaction, which in turn are simply the obverse and reverse sides of man's basic needs. Man is "driven" to work by the imperiousness of his wants. If these wants can function freely and have a reasonable opportunity of being fulfilled, then satisfaction normally ensues. Were industry rationally arranged, all of its energies would be concentrated upon meeting the needs of its producers as well as of its consuming market. It is because so many of the common urges are thwarted by the factory system in the interest of ulterior aims that irritation, non-coöperativeness, and other aspects of bad morale are so painfully common. One can acquiesce in a scheme which blocks the expression of one-quarter of our drives, provided the other three-quarters have legitimate free play; but when the proportion is inverted, rebellion is inevitable.

Most groups of workmen respond gratifyingly to any endeavors of superiors which imply interest in their welfare. Crowd phenomena elicited by suggestion undoubtedly play a part here. Where isolated individuals are the only ones in the force noticeably deficient in work-energies, the case method of treatment must apply. In fact, it is a bit absurd to view morale as a social matter exclusively and attempt to deal with it only in mass terms. The necessity for considering the peculiar personal problems of each workman cannot be so easily evaded.

A. Drives and Urges in Making a Living

1. *Studying Motives by Investigating Facts*

A. W. Kornhauser, "The Motives-in-Industry Problem," *Annals of American Academy of Political and Social Science*, 110:113-116 (1923)

We may begin the study of the causes for a particular act by asking what causal factors are present in the immediate determi-

nation of the act. All psychologists would probably agree that these determining causes are entirely included in two classes: (1) the total make-up of the individual and (2) the total stimulating situation in which he finds himself. The disagreement in regard to motives arises with respect to the nature of the individual's make-up and the part played in activity by the several elements in this total organization of the individual. Different writers emphasize reflexes and habits, appetites and emotions, conscious desires and feelings, instincts, complexes, dammed up nerve energy, bodily sets and attitudes, and many other factors. Likewise different writers have very different notions as to the origin and development of the several factors. Some would go to heredity for the cause of most activity; others would emphasize the social environment to the exclusion of all else; still others would make the experiences of infancy most important.

The view of motives which we have developed clearly makes it unnecessary for us to choose from among these various alternatives. They may conceivably all be real and usable causes of action. We believe that *any* factors—physical or mental, past or present—may justifiably be considered causes, granted only that they can be isolated and correlated with the act to be explained. The important point is not to decide in a theoretical fashion upon certain of these explanatory factors and then use these in explaining all behavior, but to start out with a scientific method and an open mind as to what particular sort of motives or causes will be useful in accounting for specific acts. If the expressed desires of an individual enable us better to understand his actions, these will be our motives; if observations of his behavior serve our purpose, they will be used; if facts concerning his parentage, experiences during infancy, or what not, prove revealing, these likewise we shall value. But always, the explanatory cause must justify itself. Its causal relation must be demonstrated and not assumed.

We shall indicate in the remainder of the paper two or three specific problems showing the method of attack which grows out of the point of view that has been developed. Our methods are, as a matter of fact, those that any concrete scientific inquiry into the causes of action must necessarily follow. There has been a marked discrepancy between the theorizing about motives and the actual investigations made. We are attempting merely to bring the general conception of motives into line with sound practical procedure.

Our examples will be taken from the field of workers' motives. One of the most common inquiries is that concerned with the motivating factors that lead to increased or decreased productive effort. One kind of answer talks much of economic motives, creative in-

stincts, and the like. Another sort of answer, and the one we would give, says frankly: We know very little about this matter and it is extremely difficult to obtain clear facts that throw light on the activities. However, we can collect some concrete evidence which will be helpful, and as we amass more and more such evidence we shall gradually have our answer as to motives. We shall study the influence on the productive efforts of workers of such factors as hours, method and arrangement of wage payment, the age, schooling and nationality of the workers, the kind of work, the kind of management, the extent of organization among the workers, and so on through a wide range of facts. We shall study these relations by comparing different groups and different plants, by comparing results under changed conditions in the same plant, by detailed study of the feelings and attitudes of individual working people and by any other scientific methods that we may hit upon.

We are likely to be told that this is all very fine but it is not a study of motives. Our reply is that it *is* a study of motives according to the view of motives we have presented. We believe it represents the only sort of fruitful inquiry into motives. To say that factual studies of this kind are not studies of motives is to imply a mystical conception of motives which sees them as special inner driving forces which are more than mere formulations of observed causal relations among acts and the events associated with the acts.

Let us carry out in a little greater detail another example in the field of workers' motives. We wish to know, in a particular plant, why the men are leaving their jobs—the causes for the labor turnover. We could, of course, say, "Instinct of migration," "Thwarted instinct of workmanship," or the like, but that would leave us precisely as wise as we were. What we need is a body of facts regarding the men and their work, and a study of the interrelations of these facts which will give us an understanding of how important various items are in relation to the turnover. One retail store, for example, experienced a reduction in labor turnover from 700 per cent to about 300 per cent in one year, following the introduction of two changes in employment practice, one in the method of training new employes, the other, summer Saturday-noon closing. Facts of this sort, supplemented by such inquiry as will make sure of the constancy of these correlations, tell more than pages of abstract theory.

The reasons for leaving that are assigned by employes during a final interview have some value, but they must be carefully and critically handled. The typical list of reasons for leaving is un-

reliable in part because of deliberate falsification by the employes who are quitting work, but much more by reason of the inability of these individuals to say what the causes for their leaving really are. In complexly determined acts of this kind it is tremendously difficult to separate true explanations from rationalizations or fictitious explanations and from real but relatively unimportant items. It is almost as difficult for the individual concerned as for some one else. Very frequently, if we are frank with ourselves, we are compelled to admit we do not know *why* we did as we did. The individual has to decide what his own motives were through a consideration of the correlated facts, just as does an outsider. Sometimes he can do it better than the outsider and sometimes less well.

We may use statistical and experimental methods in trying to get at the reasons for leaving. We may tabulate and study many sets of facts regarding the individuals who leave—their sex, age, education, nationality, marital status, number of dependents, length of service, number of previous positions, efficiency records, psychological test scores, wages and so on. Or we may experimentally vary some of the factors such as wages, hours, or conditions of work. When comparisons are made with similar facts about workers who do not leave, or with conditions before the experimental changes, some of the factors may prove to be significantly related to turnover and hence be taken as determining causes (or as motives if they happen to be thought of as implying corresponding desires). Thus if it is found that the individuals who tend to leave soon are ones with no dependents, who have held many positions, who have been lax in attendance, have been reported as restless and independent by the foreman—*these* are the significant facts to know. One can read a "nomadic impulse" or "wanderlust" or what not into the facts, but it adds nothing to the facts and it is likely to mislead.

The motives of the individual worker may be studied in an analogous fashion though with greater difficulty. Employe Y leaves and states as his reason that the work is too hard for him. Is this the real motive or is it not? If not, what *are* the significant motives or causes? The answer must depend upon a canvass of the facts about Y. If he takes another job of the same sort somewhere else, we may infer that the strenuousness of the work was not a very important cause for his leaving. Or if he was physically sound and active and the work was comparatively easy, there is a presumption against the assigned motive. Obviously many different bits of knowledge might lead to the same conclusion, or all the available facts might still leave us uncertain. In so far as

facts do not answer our question, certainly instinct-explanations will not.

If we try to go as far as we can in the present example, we may find our answer in such causal relations as these: (1) perhaps we learn that this man had been only temporarily laid off from his regular job at another plant and that now he is returning to that job. (2) Investigation may reveal that he had gone into debt with shopkeepers and that he left town immediately, without paying his bills. (3) We may find that this worker has the reputation of being highly independent and of resenting strict supervision. Such estimates of character traits are short-hand generalizations of the individual's typical ways of acting, and hence are loosely equivalent to the detailed facts of his behavior. The job in question, let us say, is closely supervised by a foreman who likes to exercise his authority. If other facts bear out this relation, we may decide that this set of facts constitutes one important cause.

We might go on with numberless examples of the same kind. Many concrete and elaborate studies have been made of conditions affecting the efficiency of workers and of the factors causing labor turnover. All these studies are contributing to our knowledge of motives. In fact any scientific collection of data bearing upon conduct and the influences shaping that conduct is a study in motives. Or at least it throws light on the questions which are ordinarily called "the problem of motives."

Summary.—Our main point of view may be stated once more. We have maintained that the study of motives means the study of concrete facts related to activity and the inter-relating of those facts. The methods of studying motives are the universal methods that science uses in collecting and interpreting facts. Sound generalizations concerning motives can be nothing more than formulations of established correlations among observed facts. If this point of view is adopted, the answer to the problem of motives is seen to depend upon all sorts of factual investigations in psychology and in business.

References.—The best literature on motives is to be found in the technical journals. Among the books, the following may be mentioned:

For discussions in terms of instincts, see:

Wm. McDougall—*Introduction to Social Psychology*

Carleton Parker—*Casual Laborer and Other Essays*

Ordway Tead—*Instincts in Industry* (This book contains a wealth of illustrative material from the industrial world.)

For critical discussion of instincts see:

C. C. Josey—*Social Philosophy of Instincts*

For general approaches to the psychology of motives, consult:

Z. C. Dickinson—*Economic Motives*
R. S. Woodworth—*Dynamic Psychology*

For Freudian views read:

E. B. Holt—*The Freudian Wish*
Bernard Hart—*Psychology of Insanity*
A. G. Tansley—*The New Psychology*

2. *A Classic Definition*

William McDougall, *An Introduction to Social Psychology,* 30, 45-46 (Luce, 1923)

We may define an instinct as an inherited or innate psycho-physical disposition which determines its possessor to perceive, and to pay attention to, objects of a certain class, to experience an emotional excitement of a particular quality upon perceiving such an object, and to act in regard to it in a particular manner, or, at least to experience an impulse to such action. . . .

Directly or indirectly the instincts are the prime movers of all human activity; by the conative or impulsive force of some instinct (or of some habit derived from an instinct), every train of thought, however cold and passionless it may seem, is borne along towards its end, and every bodily activity is initiated and sustained. The instinctive impulses determine the ends of all activities and supply the driving power by which all mental activities are sustained; and all the complex intellectual apparatus of the most highly developed mind is but a means towards these ends, is but the instrument by which these impulses seek their satisfactions, while pleasure and pain do but serve to guide them in their choice of the means.

Take away these instinctive dispositions with their powerful impulses, and the organism would become incapable of activity of any kind; it would lie inert and motionless like a wonderful clock-work whose mainspring had been removed or a steam-engine whose fires had been drawn. These impulses are the mental forces that maintain and shape all the life of individuals and societies, and in them we are confronted with the central mystery of life and mind and will.

3. *Motives in Economic Life*

C. H. Parker, *The Casual Laborer and Other Essays,* 137-138 (Harcourt, Brace and Howe, 1920)

All human activity is untiringly actuated by the demand for realization of the instinct wants. If an artificially limited field of human endeavor be called economic life, all of its so-called

motives hark directly back to the human instincts for their origin. There are, in truth, no economic motives as such. The motives of economic life are the same as those of the life of art, of vanity and ostentation, of war and crime, of sex. Economic life is merely the life in which instinct gratification is alleged to take on a rational pecuniary habit form. Man is not less a father with a father's parental instinct-interest just because he passes down the street from his home to his office. His business raid into his rival's market has the same naïve charm that tickled the heart of his remote ancester when in the night he rushed the herds of a near-by clan. A manufacturer tries to tell a conventional world that he resists the closed shop because it is un-American, it loses him money, or is inefficient. A few years ago he was more honest when he said he would run his business as he wished and would allow no man to tell him what to do. His instinct of leadership, reinforced powerfully by his innate instinctive revulsion to the confinement of the closed shop, gave the true stimulus. His opposition is psychological, not ethical.

4. *Work and the Major Human Satisfactions*

E. L. THORNDIKE, "The Psychology of Labor," *Harper's Magazine*, 144: 799, 800-802 (1922)

Most of us have been taught to think of labor as a necessary evil which men are bribed to carry on with wages or profits, much as we have been taught to think of east as where the sun rises and west as where it sets, or of two and two as making four. Man is cursed with labor since Adam; the less he has to do with it the better. Freedom from productive occupations is the Eden we all crave. Shorter hours and higher wages are the two rails on which the world's workers move toward welfare. So we have been taught.

We may perhaps concede that labor has a value for health and morality, and that we shall enjoy heaven better for having toiled on earth. But intrinsically, from the simple selfish point of view of the laborer, labor is a cloud whose only silver lining is wages. To keep the world going so many tons of coal must be mined, so many bushels of wheat raised, so many yards of cloth woven; and the world labors to produce these rather than go without them. Labor is a suffering endured only because it prevents the greater suffering of lacking what the wages or profits would have bought.

Labor laws, labor disputes (at least on the surface), and welfare schemes for laborers reflect, and in the main, confirm this view. It is, however, an unsound and dangerously incomplete view of the psychology of labor. A sound and adequate view of human nature

in its relation to labor must take into account all the important facts about productive labor, not merely the fact that much of it to many persons is objectionable. It must consider all the conditions and results of labor as well as the contents of the pay envelope.

First of all, activity of body or mind is not intrinsically objectionable to human beings. On the contrary, if the activity is within the individual's capacity in quality, quantity, and duration, so as to be done without strain, it is intrinsically desirable. Boys and men leave their farm chores to engage in more violent activity in hunting. The lawyer stops thinking of his brief in order to think harder in the chess game. The housewife abandons the family mending to do fancy embroidery.

Nor is productive labor intrinsically more objectionable than some activity undertaken for sport. Human nature has no predilection for the useless as such. On the contrary the child would prefer to have his mud pies edible, the hunter would prefer to secure a useful trophy, the lawyer would enjoy his game of chess no less if by some magic it made two blades of grass grow where one grew before. Indeed, it adds somewhat to his enjoyment if he thinks of it as valuable mental training or a healthful mental relief.

In fact, there is hardly a gainful occupation that is not used as a cherished pastime by some men and women. . . .

Wages and profits are rarely the only reward for labor. Many workers work to some extent for love of the work. Still more are paid in part by the approval their skill and achievements receive. Some are paid in part by the sociability of the workers or the friendliness of the boss. In fact, almost every fundamental human appetite may be gratified to some extent by productive labor.

We should not think of the laborer as leaving most of his human nature behind him when he goes to work, and becoming then a single-hearted devotee of money. We should consider all the instincts and habits, some of them deep hidden, that move him as truly when he works as when he rests with his family or plays with his friends or fights or votes or marries.

There are five fundamental trends in human nature which specially deserve our consideration. The first is the satisfyingness of activity, physical or mental, at which one can succeed. Man tends to do something when he is wakeful as truly as to rest when fatigued. Continued idleness is seductive when accompanied by sociability, or stimulation by novel sights and sounds, or a sense of superiority to those who cannot afford to be idle, or opportunity to display one's power or wealth; but mere idleness *per se*, as in a

sanitarium or jail, is attractive only to exhausted bodies or minds. The labor problem is not so much to bribe men from idleness to activity as to induce them to be active in ways which are advantageous to the community.

The second is the satisfyingness of mastery. To have other human beings step out of the way, bend the knee, lower the glance, and obey the command, is worth more than fine gold to most men and to many women. It would be an interesting study to ascertain whether a plumber has a helper, a farmer a hired man, a waiter a bus boy, and so on, simply because these helpers really increase efficiency, or partly because the plumber, farmer, and waiter thus have some one on whom to gratify their craving for mastery.

The third is the satisfyingness of submission—*to the right kind of man.* Contradictory as it may seem, it is as natural for human beings to submit to the person whose size, looks, voice, prowess, and status make him an acceptable master, as to exercise mastery themselves where they can. The same man who enjoys mastery almost to the point of tyranny over his employees may enjoy submission almost to the point of servility to some business giant, or to some hero of baseball, or even to his wife. The strength of this tendency to submissive loyalty varies, being much greater in some men than in others, and greater in general in women than in men. The same man who excites ready loyal submission in some, may thus excite rebellion and attempted contra-mastery in others; and some men may never, as workers, find a foreman whose power over them is not a constant irritation.

Probably the present work of the world cannot under present conditions be done without a balance of dissatisfactions, because for the great majority there is too much need for submission and too little chance for mastery. Roughly speaking, labor has to be too submissive to suit human nature. But not all of the submissiveness is annoying, and the two trends, though often opposed, need not always be. If Jones appeals to Smith as a creature to be mastered, and Smith appeals to Jones in the same way, both cannot be satisfied. They are not necessarily and inevitably opposed, however. If Smith appeals to Jones as a great man whose smile produces thrills of delight, whose nod is benediction, whose commands are unquestionable, both may be happy.

Next to be considered is the satisfyingness of company and cheerfulness. Man is by nature gregarious and fond of human happiness about him. He likes to have human beings around him and to have them smiling and laughing rather than peevish and sad. The department store and factory are actual reliefs to many girls whose home life is essentially a complaining mother and crying children.

Many a young man gets enjoyment from the bustle of the office very similar to that for which he pays at the amusement park or on the excursion steamer.

Last and most important is the satisfyingness of that feeling that one is somebody of consequence, who is or should be treated respectfully by his community, which we may call the love of approval. The human animal derives keen satisfaction from humble approval, as by admiring glances of anybody, and from all forms of approval of those whom we esteem. The withdrawal of approving intercourse by our equals or superiors, and looks of scorn and derision from anybody, provoke a discomfort that may strengthen to utter wretchedness. . . .

This hunger for consideration, approval, and eminence is one of the great moving forces in human life. Under present conditions in America it deserves to be ranked along with the primary motives of physical hunger, sex, and the craving for physical safety and the intolerance to bodily pain. . . .

It may be accepted as axiomatic that labor which adds to the laborer's sense of worth and consideration by those whose opinion he lives for has a plus over its money wages, and that labor which detracts therefrom has a lack which wages or some other consideration must supply.

5. *The Instinct of Workmanship*

F. W. TAUSSIG, *Inventors and Money-makers*, 12-18 (The Macmillan Co., 1915)

The instinct of contrivance is widespread in the animal world, among insects, birds, mammals (the beaver is a notable illustration). In origin doubtless it goes back to the fact of having been at some stage advantageous. For its evolution, as for that of every other instinct, one turns almost as a matter of course to the Darwinian organon. Those creatures which were disposed to contrive had a better chance in the struggle than their fellows; they survived, and their nervous structure was transmitted to their descendants. We need not concern ourselves with the problems that vex the biologists and psychologists,—the first steps in variation, the mechanism of the transmission of characters, the relation between body and mind and that between instinct and experience. For our purposes it suffices that all are now agreed on the transmission of propensities as well as of anatomical structure. And among the inherited instincts, in men as in animals, we have to deal with that of contrivance and construction.

That there is a well-marked instinct of this sort is made toler-

ably certain by another kind of evidence; its unmistakable spontaneity and extraordinary development in some individuals. When a trait appears overwhelmingly and unmistakably in a few, we may infer that it is present to some degree among all, even though so weak at the other extreme of the scale as scarce to be recognizable. Such is the case with the instinct of sympathy, love, devotion,—powerful to our amazement among a chosen few, hardly to be detected among the grossly selfish, yet in no person quite absent. The instinct of rhythm, again, is so spontaneous and impetuous in those of poetic and musical genius that we must suspect that we have to deal here also with one shared universally. So far as concerns the instinct of contrivance, we are familiar not only with its extreme manifestations but with its wide dispersion.

Every child likes to build with blocks and play with tools. When schoolboys or college undergraduates carve letters and numbers on their desks, they are no more deliberately wicked than they are when skylarking or ball playing: they obey the inborn bent. Every man likes to whittle. A new dodge appeals to all. The born inventor is among the best known figures in the chronicles of industry. No doubt the bent to contrivance is less specific in its direction among men than among animals, more various in degree, more likely to be overlaid and complicated, to be thwarted or concealed. Such is the case with all our instincts, but it is none the less a true instinct, pressing imperiously to a specific kind of activity. . . .

If now we admit that there is an instinct of contrivance, and that there is a keen satisfaction in following it, we are led to question the proposition that progress in the arts depends on an experience or prospect of gain. This had been the view of the older utilitarians: men contrived simply because this was conducive to gain, and would not contrive unless prompted by the experience and prospect of gain. Hence there must be premiums and prizes, patent laws, protected trade-marks, the bait of profit. But if there is a spontaneous impulse,—spontaneous in the sense of not being dependent for its initiation on a calculated gain,—we may be led to conclude that the patent system, for example, is a huge mistake. Men would invent anyhow: they obey the instinct and therein take joy. So poets are actuated, musicians, men of science. In their activities we have long recognized the intrinsic satisfaction from the exercise of inborn impulse. It is at least a question whether copyright has aroused genius or evoked literature. The social reformer of idealistic type declares that all such sordid motivation is beside the mark. No doubt, once the practices and habits of the selfish competitive régime are established, men of all sorts will fall into them. But to say that the forward march of

the industrial arts is dependent on a patent system is like saying that poetry, music, the plastic arts are merely forms of money-making.

6. *Why Men Work*

G. H. MILES, *The Will to Work*, 5, 76-78 (Rutledge, London, 1929)

The average man has become so accustomed to the routine of his daily task that he seldom pauses to think why he works. If asked the reason he toils day by day, year in and year out, he will probably be astonished at such a question and reply, "To get my living, of course." Most people who work, normally do so, no doubt, for a living, yet seldom is work done from this motive alone. There are many other closer and more pressing things that influence the "will to work" and hence the quality and quantity of the daily work done.

For instance, an engine-driver who is faced with the task of getting up a steep gradient in bad weather is not thinking at all about getting his living. What keeps all his wits at work is a very real interest in nursing and coaxing his engine, and a determination to keep good time. The bus-driver, while on his route, seldom thinks of his job as a means of keeping body and soul together. He is interested in his passengers, and although he may hustle a dilatory passenger, he can spare a cheery word and give a helping hand to the cripple who hobbles aboard. It is only when he is in danger of losing his job or finds that he has been spending beyond his means that he gets a very effective reminder that he must work for a living. . . .

Though there are in reality very many reasons why men work, there is in most people's minds one which predominates and which influences the general attitude towards work. Thus some people may be mainly interested in the gains and rewards which work brings. Others may find that the work itself gives a satisfaction which well repays their efforts. A desire to be of service may prompt others. In some cases there may be only the desire to escape the consequences of not working. The development of this dominant attitude is the resultant of many varied factors. The person's physical and mental make-up and the result of his early environment, training, and habits have an influence throughout his life. The attitude and ideals of those with whom he associates and of the people for whom he works all play their part. He is, as it were, surrounded by a field of influences and is attracted or repelled according to the way they affect his personality. If in his work there is scope for the development of his abilities, he responds and

becomes a better and more complete human being in the process. On the other hand, work that offers scope for only a small part of his activities cramps and narrows his development. Work that gives only the prospect of gain tends to develop his activities in this direction to the detriment of other aspects of human activity.

The leaders of industry have therefore a great influence on the direction which the development of the individual population takes. If a firm's efforts are directed mainly towards the paying of big dividends and the desire for gain is uppermost, this policy influences all its members. Each worker in time becomes obsessed with the desire to get all he can. It is simply a natural inevitable human response to environment. It is, moreover, a reversion to a strong primitive, anti-social, unintelligent form of activity. The desire for gain in time replaces the "will to work"; and when a group becomes imbued with a desire to gain without working for it, the whole basis of human relationship is weakened and the end is in sight.

B. Sources of Dissatisfaction

7. *Restriction of Output*

C. S. Myers, *Mind and Work*, 111-123 (University of London Press, 1920); reprinted in U. S. by permission of G. P. Putnam's Sons

Output may be restricted by the employer or by the employee; either of them may restrict it deliberately or more or less unconsciously.

Deliberate restriction of output by the employer may come about through at least three causes, viz.: (1) the dearth of raw material, (2) the fear of flooding the market, coupled with the desire to maintain an artificially high price for his manufacture, and (3) the need for co-ordinating the requirements of different departments of his factory. More or less unconscous restriction of output by the employer may arise (1) through bad organisation and out-of-date equipment of his factory, (2) deficient training of his employees in the best methods of work, (3) ill-considered arrangements of the working hours, (4) inadequate rest pauses, and (5) defective selection of his employees for the task for which they are best fitted.

The prime causes of deliberate restriction of output by the employee at the present day are discontentment, suspicion and jealousy. An important cause also lies in the fear that with increased output the scale of piece rate or task rate payment will be reduced. The rate has been not infrequently cut when men begin to earn

more than the employer had thought possible when setting the rate. There is a good instance on record of a girl paid by piece rate, who was shown by a passing expert a more efficient method of working by which she could earn far higher pay. Later, however, she was found to have returned to her old method, and the reason she gave the expert was that she knew her employer would cut the rate if his girls earned more than a certain sum per week.

Although such extreme cases have not occurred in this country, yet there are many instances—far more numerous than is generally supposed—in which the rate has been cut here, and it is undoubtedly an important cause of the deliberate restriction of output by the employee. One of the absurdest cases on record occurred where the earnings were originally based on the performance of a certain task in 5 hours. The workers finished it in 4 hours, whereupon the time rate was cut to 4 hours. The workers then managed to finish it in 3½ hours, whereupon the time rate was at once cut to 3½ hours. The workers then finished the job in 3 hours, and the time rate was further cut to 3 hours. But by this time the workers had learned wisdom. They now took 7 hours for the job. The time rate was raised to 4 hours, but without effect, then to 5 hours; whereupon the workers finished the job in 3½ hours. Once again the time rate was cut, and once again the job took 7 hours to accomplish!

The remedy for such senseless warfare is perfectly obvious: systematic investigations in time study must be conducted at the outset with the approval and coöperation of all concerned, so as to fix a fair piece or time rate, satisfactory to all concerned, which will honestly be maintained so long as the working conditions are not materially changed.

Another cause of deliberate restriction is the fear of disloyalty to less capable fellow-workers. This can only be safeguarded (1) by the establishment (based on scientific study) of a recognised range of individual differences of output, within which workers may feel secure in their employment, (2) by a proper selection of workers at the outset according to their special abilities, and (3) by a guarantee against loss from unemployment when arising not through any fault of the worker.

It may here be pointed out that the restriction of output by workers has been shown in the United States to occur in what are there called "open shops," i.e., where there is no trade unionism, as well as in shops where the men are members of a trade union. Restriction of output, therefore, is not limited to trade unionists.

Output is unconsciously restricted by workers as the result of a physiological process of adaptation, protective against undue fa-

tigue at the end of the day. The worshipper in church or the child at school cannot be expected to give unremitting attention to his prayers or lessons; the shorter the period of his attendance, automatically the better maintained will be his attention over that period. So, too, the worker unconsciously proportions his efficiency to the length of his working spell or shift. It is owing to changes in such unconscious adaptation that reduced hours have so often yielded as great an output as was obtained before reduction, or even an increased output. The unconscious nature of this process is doubtless indicated by the fact that the reduction in working hours may not show its full effect until many weeks after the change. Such delay would not occur if previously there had merely been a deliberate restriction in output. Shorter hours do not owe their beneficial effects to increased spurts. Beyond certain limits, spurts, like drug stimulants, are in the long run harmful to efficiency. Riveting competitions and the like, where work is carried out under abnormal conditions of volitional tension, yield no information whatever of the proper daily output that may be expected from the worker, nor of restricted output.

More or less unconscious restriction of output by the workers also arises from general slackness, on the part either of management or labour, from tradition ("it has always been the custom to turn out so much"), or from the general factory routine which would be distributed if an increase in production occurred in any one department.

A few examples of undoubted restriction of output by the workers are here given. Night after night in a munitions factory of the United States the output of sixteen women drilling holes was found to be 3600 precisely. If the machines stopped for any reason, they evidently put on a spurt afterwards, because the output remained constant over the period of examination; indeed, it was found that this spurt was capable of effecting a temporary increase of from 75 to 90 per cent (elsewhere even from 136 to 142 per cent) in speed of production. In another instance, six women were gauging fuses. Five of these women, day after day, gauged 1315 fuses exactly. A man, whose output was observed for 45 nights, while employed in an operation on fuses, finished, save on one night, exactly 1000 fuses per night, while three others, similarly employed, turned out this number on 47 nights out of 50, 40 out of 49, and 46 out of 51 nights, respectively.

In the shops of a certain factory in this country 5000 of a certain article were produced weekly. The management decided to open a new shop, in which the mechanical conditions were practically the same as before, excepting that inexperienced operatives

were engaged, who were unfettered by tradition, knowing nothing about the work. At the end of six months' practice this new shop produced 13,000 of the articles per week, whereas each of the older shops, with its restriction of output, continued to produce only 5000.

Another case on record concerns six units of machinery, each of which produced 2500 articles per week, the total output being therefore 15,000. It was decided to remove some of the machinery, unit by unit, to another factory, and at the same time to give a bonus on output to the workmen on the remaining units. When the first unit was removed, the total output of the remaining five still kept at 15,000 per week; when the second, third and fourth units of machinery were successively removed, the total output of the remaining units nevertheless reached 15,000 per week—a final increase in output of 200 per cent being thus attained.

A valuable method of detecting restriction of output is to take the average output of a number of workers on the same job over a determined period, and to observe to what extent the output of individual workers falls short of or exceeds this average. Excessive uniformity of output among different workers thus compared is a sure indication of restriction. The forms of the individual daily work curves showing the output during each consecutive hour of the day, are also highly instructive. If the output rises considerably during the last few hours of the day, there is good reason (apart from the effects of end spurt) to suspect that there has been restriction earlier in the day. At the same time, it is difficult to lay down any general rules as to the effects of restriction on the work curve of different individuals. While some workers may prefer to restrict their output earlier in the day and to make it up, if necessary, towards the close, others may push hard at the beginning of the day and slacken towards the end. But any such departures from the normal will generally be revealed by a systematic study of the individual curves of hourly output.

Where several workers contribute jointly, by team work, to a given job, there is apt to be uniformity and restriction of output. This is especially likely to be the case (1) when a flat uniform day rate is paid, or piece rate earnings are shared by the team, in a prevailing atmosphere of discontentment or want of interest, or (2) when a uniform task is exacted throughout each hour of the day. In one such works the daily output was fixed at 100 items, and during each hour of the day a constant output was maintained. The daily curve of hourly output was therefore a straight line. This purely artificial condition, imposed on the workers by the

management, may have involved undue effort at the beginning and end of each spell, but it almost certainly provoked some restriction of output during the middle hours of it, for no one can maintain a uniform output throughout the day under natural conditions.

Uniformity of output among different workers is certain to occur where an excessive number of men are engaged in team work upon a job. A case of this kind is on record where men employed in loading coal at one centre were paid a certain rate, while those engaged at another centre on similar work were only being paid two-thirds of that rate. Seven men left the latter centre to go to the former because of the higher rate there, but in two months' time they returned, saying that they could not earn so much money at the higher rate on account of the slackness prevailing through the large number of men employed on each truck.

8. *Army and Plant Morale*

E. L. Munson, *The Management of Men*, 738 (Holt, 1921)

The parallelism between military and industrial morale is brought out by an inspection of the following correspondence items:

Military Morale	*Civilian Productivity*
Maximum of possible accomplishment	Maximum productiveness
Faith in commanders	Trust in superiors
Team work	Coöperation
High spirits	Interest in the work
Contentment	Enthusiasm for the job
Level of average morale	Level of average efficiency
Dissatisfaction	Listlessness at work
Criticism and complaint	"Conscious withdrawal of efficiency"
Desertion; disorder	Labor turnover; sabotage
Unwillingness to obey orders	Strikes
Mutiny	Riots

9. *Cycles of High and Low Morale*

R. B. Hersey, "Periodic Emotional Changes in Male Workers," *Personnel Journal*, 7:459-464 (1929); reprinted by permission of Williams & Wilkins Co.

Throughout the whole of the past year a group of normal workers were carefully studied in regard to (1) overt behavior, such as efficiency, lateness, coöperativeness, verbal outbursts, constructive ideas, absentism and so forth; (2) emotional behavior; (3) domi-

nant trends of thought and revery; and (4) such physical and physiological items as could be either detected or measured, such as blood pressure, colloid content of blood, weight, hours of sleep, illnesses or pains, and feelings of fatigue. Special emphasis was laid on the analysis of relationships existing between these items and environmental conditions or personality traits. The observer spent all of the working day in almost constant contact with the workers studied, and much of the time after work with them either in their homes or elsewhere, endeavoring thereby to obtain a complete picture of their whole life. All of them had full knowledge of the purpose of the study and coöperated fully in both describing and analyzing their behavior. Twelve men were followed throughout the year and five others were studied for periods of several months. The material presented in this paper represents merely one phase of the data collected.

During the course of the year it was noticed that often there were days when the emotional tone of a worker was unusually high or low, though no definite causal relationship was discernible. This peculiarity was not looked upon at first as unusually significant; but a numerical scale was worked out for the various emotions, varying from *happy* at plus 6 to *worried* at minus 6, with the other emotions placed in between as psychiatric experience would seem to dictate. After the daily changes of the workers had been plotted, a certain regularity in the longer up and down swings of their average emotional states was detectable. On closer study it was seen that each worker showed definite periodic changes in his average weekly emotional tonus which could not be accounted for by environmental happenings, climatic changes, or physiological causes of a kind that were measurable in the plant. Moreover, this cyclical movement varied characteristically for each man in regard to length, amplitude, and nature of the emotional and objective changes involved. The length of each worker's periodic changes—measured from "low" to "low,"—averaged all the way from three to nine weeks, but in no case did the length of any period pertaining to the same person vary more than a week from his own average. The amplitude showed similar individual variations, some men showing a difference of as much as 6, others only 2, points between the highest and lowest phases of the "cycles." The amplitude of the changes seemed also to be more affected than the length by the worker's organic state and relation to his environment.

Though the individual workers differed in regard to the changes effected in them, a general picture of a somewhat typical high and low showed these characteristics:

	High	*Low*
Production	Work comes easily; production is at least average, often above; fewer complaints are made about the way the work is going, though one is likely to get less done than he could, due to interest being attracted by all sorts of stimuli in the environment and willingness to take work and its importance less seriously; ready to stop and tell the other man how to do his work.	Usually no more than average is accomplished unless worker is driven; tendency towards less; work an effort; its difficulties exaggerated. On skilled work, however, requiring planning, or in executive work, sometimes more is accomplished than in manic phase, due to saving of time and effort by sticking to the job on hand. In purely repetitive work necessity of keeping production up to standard likely involves great physical cost. Low phase often affords starting point for creative spark, which later manifests itself in manic culmination,—birth of genius.
Effort	Usually felt to be less than production.	Greater than production.
Feelings of fatigue	Usually not many.	Always more.
Sleep	Less.	More.
Blood pressure	Apt to be higher.	
Weight	Often slightly lower, if two periods close together.	
Sexual energy	Apt to be greater.	
Extra-plant activities	Many.	Few.
Psychic attitude	Powerful over the environment; tendency toward anger over rebuffs rather than pessimism; joking and laughing; confident, looking toward betterment and opportunity to enjoy the beauties of the world and himself; hard to handle; best way to stimulate him with a problem; praise and criticism both have little effect.	The world weighs heavy; the worker hates to be forced to meet crises; assimilates rebuffs and criticism with difficulty; needs encouragement and praise at lowest period, a whip to force him into proper efficiency after starting up the cycle; more ready to be suspicious and irritable, down-cast and worried; ready to quit or at least to talk about it on slightest provocation.
Mental pictures	Objective, real, daydreams likely to end in action immediately; how to get ahead and better himself often in his mind though he may not be dissatisfied with particular job.	Subjective, pessimistic, unreal, fanciful.

Until the tentative hypothesis here advanced is verified by a study of more cases, no definite theory of causation or of practical application is possible. In spite of that difficulty, however, the impressive evidence of a definite periodic change in the cases studied leads one to the speculation that periodicity may be associated with variations in the general relationship existing between energy spending and energy building mechanisms, involving (1) metabolic activity; (2) sex and other ductless gland functioning; (3) autonomic nervous equilibrium. In other words, these are subject to daily variations about a moving axis which in turn has a cyclical periodicity; but why this axis should move in these cycles is still a complete mystery. If the further investigations now in progress confirm the present hypothesis, industrial managers will find it wise to take the fact of periodic changes into account in dealing with their workers and executives, setting tasks, studying fatigue in both its daily and its accumulative phases, and analyzing their own emotional and mental efficiency.

10. *Quantitative Analysis of Morale*

J. D. Houser, *What the Employer Thinks*, 176-180 (Harvard University Press, 1927)

Twenty "factors" have been selected as representing the most important elements of the working relationship between employees and the organization. These are:

I. Adjustment to Job:
- Breaking in—new job
- Opportunity to use experience
- Clearness of instruction

II. Supervision:
- Freedom to consult
- Initiative and independence allowed in work
- Judgments of results
- Courtesy

III. Incentives:
- Security of job
- "Welfare work" (insurance, pensions, sick benefits)
- Adding to ability
- Remuneration
- Opportunity for promotion

IV. Participation—Expression:
- New ideas or suggestions
- Grievances
- Knowledge of larger affairs (company and departmental)
- Changes in work policies

V. Working Conditions and Facilities:
General working conditions
Equipment, tools, etc.
Fellow workers
Work schedule

"Attitude" in general is expressed by "feeling." An employee's feeling toward the company for which he works and toward his working relationships may range from bitter hostility to enthusiastic approval and friendliness. If an employee is questioned regarding his feelings about each of the above factors and if the degree of his feeling about each can be measured, then some definite conception will be gained of that employee's attitude as a whole. (Such elements as are not under the control of minor executives can, of course, readily be isolated.)

The procedure is briefly as follows: A certain percentage of the total number of employees in the organization is interviewed individually. This percentage should be sufficiently large to present a true "sampling" of all the various attitudes and thus to give a complete picture. Each employee is interviewed apart from his work and by a skilled interviewer—an outsider without knowledge or preconceived ideas about the organization. Moreover, the talk is always prefaced with a careful and convincing explanation to the worker that no matter what he says, no harm to him will result. He is shown a letter signed by the chief executive, interpreting the interview as a constructive piece of personnel work and asking each employee for full and frank coöperation. He is never asked his name, for, as he is assured, the individual answers and reactions are valuable only as they contribute to group conclusions.

Carefully standardized questions, put always in the same way and with the same inflection, about his feelings toward every factor, are asked of each worker. The questions, for instance, about the factor "Adding to ability" are:

Are you learning things on your job that will be of use to you later on, either on this job or on a higher one? Are you getting a chance to learn and study some other job? How much do you feel that you are growing on the job?

The employee's response is listened to attentively and then compared with those on the following list, which was constructed on the basis of many hundred responses to this same question. The intervals between the five "type" responses are approximately equal—that is, there is approximately as much difference in *degree* of feeling between No. 4 and No. 5 as there is between No. 1 and No. 2 or between No. 3 and No. 4.

5. The company certainly does encourage me and offers me every opportunity to develop and make progress. I'm sure I am being given every chance I could be.

4. Yes, there are a number of pretty good chances ahead. I believe I'm getting some new knowledge and ability every day. It could be a little better, perhaps, but the company takes an interest and that's an encouragement.

3. The chance for learning here is all right, I guess—about average—no kick as far as I can see.

2. You've got to pick most of it up for yourself. The job doesn't give you much chance. I've learned about all I can. I feel that more interest should be shown along this line.

1. Don't think I'm getting along at all! I'm in a fierce rut! No chance to learn! There's no encouragement at all to try to learn or go ahead.

The interviewer has this scale, and a similar one for each question, completely memorized, and has had training in identifying employees' responses with those on the scale. The values on the scale range from that of No. 1, which represents *hostility,* through No. 3, representing *indifference,* to No. 5, which denotes *enthusiasm.* By comparing each employee's response with the scale, a numerical value can be given to it.

By adding the numerical values of the responses to all the questions and then averaging the total, a single figure is obtained which expresses the attitude of the individual employee. By averaging these figures for all the employees interviewed, a single figure expressive of the collective or group attitude is obtained. In organizations where all the twenty factors are not found, the values of responses to the factors present are averaged. The following figures show the actual result of the use of this method in one large company.

Averages of Employee Attitudes.—The figures below are the averages of the scores of all the employees interviewed and express the "average" attitude on each element of their working relationships. In this case, the scale runs from 1, the lowest possible score, indicating unqualified hostility, through 3, the midpoint, indicating mere neutrality or indifference, up to 5, the highest possible score, indicating unqualified enthusiasm or favor. All scores below 3 therefore show disfavor, which grows greater as they approach 1, while all scores above 3 indicate favor, which increases as they approach 5. The scores here are averages of the scores of all the employees' attitudes toward each element of their jobs.

	Item	Score	Average
I.	Adjustment to job:		
	Breaking in—new job	2.9	
	Opportunity to use experience	1.7	
	Clearness of instructions	2.7	
			2.4
II.	Supervision:		
	Freedom to consult	3.9	
	Initiative	2.0	
	Judgment of results	1.9	
	Courtesy	2.4	
			2.6
III.	Incentives:		
	Security of job	3.0	
	Welfare work	2.0	
	Remuneration	2.7	
	Adding to ability	2.6	
	Opportunity for promotion	2.2	
			2.5
IV.	Participation—Expression:		
	New ideas or suggestions	1.9	
	Grievances	2.8	
	Knowledge of larger affairs	1.6	
	Changes in work policies	2.1	
			2.1
V.	Working conditions and facilities:		
	General working conditions	3.5	
	Equipment, tools	4.1	
	Fellow workers	4.3	
	Work schedule	3.2	
			3.8
	Average for Company (Index of morale)		2.7

The average for the Company (2.7) clearly indicates that the attitude of the working force, taken as a whole, is one of indifference slightly shaded by disfavor. The separate figures as clearly point out that the employees' very favorable opinions of their working conditions and facilities is offset by the low esteem in which they hold their opportunities for participation and self-expression. Figures such as these have obvious significance for management.

11. *Impulses and Inhibitions in Work*

HENRI DE MAN, *Joy in Work,* Appendix (Holt, 1929)

POSITIVE AND NEGATIVE FACTORS AFFECTING THE WORKER'S ATTITUDE TOWARDS HIS WORK

Impulse to Joy in Work (+)	*Hindrances and Inhibitions* (—)
I. Primary Motives	I. Technical Hindrances and Inhibitions
1. Instinct of Activity	1. Detail work
2. Instinct of Play	2. Repetitive work
	a. Monotony of motion
	b. Reduction of Initiative
	c. Slackening of attention
	d. Hypnotic effects of rhythm
3. Constructive Instinct	3. Fatigue
4. Instinct of Curiosity	4. Unfavourable Technical Conditions
5. Instinct of Self-Assertion	
6. Possessive Instinct	
7. Combative Instinct	
II. Accessory Motives	II. Intra-Occupational Social Hindrances and Inhibitions
1. Herd Instinct	1. Dissatisfaction with Working Conditions
2. Longing for Mastery and Need for Subordination	2. Unjust Wage Systems
3. Æsthetic Gratification	3. Disciplinary Subordination of the worker
4. Considerations of Self-Interest	
5. Considerations of Social Advantage	
III. Sense of Social Obligation	III. Extra-Occupational Social Hindrances and Inhibitions
	1. Permanent Allocation to a Lower class
	2. Insecurity of livelihood
	3. Conventional Disparagement of Manual Labour

12. *What the Worker Wants in His Work*

WHITING WILLIAMS, *Mainsprings of Men,* 56-62 (Scribner, 1925)

For three weeks in the steel plant we had shovelled hot and dusty brickbats out of the caved-in furnace—a motley crew of Mexicans, Indians, negroes, and various foreign-born unskilled laborers, working fourteen hours during the night-week, ten hours

during the day-turn, and eighteen or twenty-four hours every second Sunday. The start of the fourth week brought the first evidence of that most elusive element of all working conditions—the influence of the job upon its holder's standing in his community.

"Charley, how'd you like to join the millwright gang?" the foreman called to me. He appeared to think he was offering a distinguished honor—in spite of his explanation that it paid only two cents an hour more. The change was accepted with indifference: surely so slight an increase in pay could not mean much of a promotion. Half an hour sufficed to prove my error. As I came by my former companions, carrying oil-can and wrench, I made a veritable sensation! Every one of these old friends leaned upon his shovel and wiped the sweat and dirt out of his eyes while he exclaimed:

"Hey, Boodie! W'ere you catch-em job?—Meelwright gang? Oil-can and wr-rench! No more . . . shovel! My Ga-wd!"

From that moment it was possible to talk familiarly with the first and second helpers, those experts who peer through their colored spectacles into the changing conditions of the furnace's "bath" of "hot metal" up to the instant of the "tapping." For three weeks I had puzzled why these men would have nothing to do with me. Now we were suddenly become pals! But this was not all. My elevation brought honor not only inside but outside the plant. Without doubt, if my wife had lived near by, she would have received the congratulations of the wives of the unskilled laborers: "Your man he catch-em fine job!" And not one of them but would have observed closely the next day, to see whether she continued to speak to them!

All this amazing change of status, both as a worker and a citizen, on a difference of only two cents an hour! . . .

Numberless other instances could be cited of this outstanding fact: *everywhere among the workers a man determines the social standing of himself and his family, not so much by the earning power as by the NATURE of his job.*

This universal connection between a man's work status and his community standing—this it is that constitutes by far the most important as well as the most elusive of all the "conditions" of work. This is what enlarges enormously the boundaries of a man's job. This is what provides those "social handles" of the pay-cup—that "social fringe" which makes a man's work infinitely more than that combination of mud, shovel, and arms which so fills the eye of the observer. Away out beyond these extends the thought of the doer of the task. Constantly he pictures the reward which

is to follow. Of that reward only a part is put into the pay envelope. The rest of it spills over into satisfactions astonishingly intricate and imponderable—and indispensable. Among these, however, the assignment of a gratifying social status is only the final capstone set upon a whole series of lesser but ascending rewards.

What is this series?

Surely it starts with the simple gratification of mere physical activity. From the time of our mother's first urgent appeal to "Please sit still!" not one of us but has learned the genuineness of this first reward of action. Not one of us but knows, however, that in addition to this minimum delight of muscle exercise, we wish to see something worthy transpire through our effort. . . .

The denial of exactly this simplest satisfaction probably explains that first great strike or "walk-out" of recorded history; the laborers there by the Nile doubtless felt that bricks—good bricks, mind you—simply could not be made without straw!

This reward of creation naturally grows greater just as rapidly as the creator finds it easier to picture the usefulness of his effort to others.

"The boys gotta stop work unless I keep after them pumps," the landlord in the mine town repeated proudly. In the same way "Old Evan" would call back after we had finished our job of bracing the roof and removing the "fall" of rock, which had completely stopped the work of all the colliers in that quarter of the pit:

"Wull, it been plain to see, now beunt it; they cawnt roon the bloody mine without *oos!*" . . .

It is exactly this increasing measurement of the usefulness of the job—*and so of its doer*—which carries the thought of the measurer out beyond the factory walls and into the service he renders, in the highways and byways of the town and the nation. And by the same token, it is this measurement which makes the doer so sensitive to the weighing of his contribution by even his most distant fellow citizens. If these do not recognize his merit, perhaps his own weighing of the matter is wrong—*perhaps!* It is this uncertainty, accordingly, which helps to keep him "talking shop"—everlastingly weighing this job with that until, finally, he discovers, in one way or another, that the question has been settled and his function has been given everywhere among his fellows something like a proper rating. Only then does he feel that he genuinely knows what his job really is, and what it truly pays him.

It is impossible, therefore, to judge the effect of either wage or

other conditions of work apart from the relationships the work permits with other persons. What every worker knows is this: that sooner or later the final joy of his work is settled, not by him, nor by his employer, but by the social standing awarded him by his fellow citizens.

13. *A View of Manual Labor*

HENRI DE MAN, *Joy in Work*, 213-214 (Holt, 1929)

There has to be considered as an accessory social cause of the industrial workers' distaste for their work, the conventional disparagement of manual labor. This disparagement influences the worker by suggestion, and tends to inhibit the instinct of self-assertion which seeks gratification in working activity. Such a general attitude towards manual labor is the socio-psychological expression of the fact that the performance of such labor is enforced by poverty, implies a position that is economically disadvantageous, and is the occupation of a class which for centuries was deprived of political rights, and which is down to this day looked upon as being of inferior social status. The consequences of this disparagement of manual labor have been discussed seriatim in the foregoing pages.

It would be futile to follow the example of those well-meaning philanthropists in various countries who carry on "propaganda" on behalf of a higher valuation of manual labor. No such simple method will suffice. Little will be achieved by dictating to children in the elementary schools essays about the beauty and the dignity of manual labor, or by ornamenting our public squares with the sculptures by Constantin Meunier romantically portraying the heroism of the workers' lives. Reality, sarcastically underlining the contrast between these artificial valuations and the actual judgments regarding manual labor that underlie our whole social order, is too near to those for whom such flattering unction is provided for them to be willing to close their eyes to the facts. They reject the proffered opiate.

There are concrete, institutional causes for the disparagement of manual labor and of those who perform it. Industrial work actually is burdensome, when it is done under stress of need, when it is enforced on social inferiors by social superiors; its performance actually is a mark of social inferiority when it is done by persons who may stand at the lowest grade of culture and intelligence without being unfitted for it; it actually is less intelligent than mental work when it is nothing more than the work of semi-automatized machine-slaves; the lot of the manual worker actually

is one little to be envied when his work can provide him with nothing more than the barest subsistence, and when it leaves him the minimum of freedom and pleasure; it actually is debasing when it compels a man, under the lash of hunger, to obey a master in the choice of whom he has had no say, and over whose decision he has no influence; it is certainly anything but beautiful when it has to be carried on in hideous, gloomy, prison-like factories; it certainly is unhygienic when it exposes those who perform it to the risks of over-fatigue, occupational disease, and avoidable accidents; it unquestionably is dirty when the workers have to go home from their daily rounds blackened with grime, powdered with dust, or smeared with oil. In a word, manual labor reserved for a class occupying an inferior social status is, beyond question, disparaged.

14. *Superiority Indicated by Conspicuous Leisure*

WHITING WILLIAMS, *What's on the Worker's Mind?* 124-125 (Scribner, 1920)

My second week of coal has shown that bad living conditions are not a necessity unless the coal-seam of the town or camp is extremely short-lived; also, I think, that money spent by the company in better surroundings brings good returns in better and more productive workers, as mentioned before. It also appears to me unquestionable that the miner's work carries him much closer to a genuine self-respect than does the steel-mill laborer's job. With this start the increase of it by any and all means would seem to bring good results in many ways. It also seems certain that in the limited opportunities of the camps the most outstanding way to indicate your standing is not to earn and spend as we do, but just not to earn, seeing that there is so little to do with the money.

That must be the reason why the operators claim that even when they have the orders and the needed cars, the difficulty is to get the miners to stay "inside" for a good day's and a good week's work. Where a man can show by his house or his flivver or by other of his possessions that he is "getting on," a very definite value is given to earning the wherewithal. But in a community where no house can be bought—because the town may not be there a few years later—and where the roads may be too bad for a flivver, then the only other way of indicating the status of a self-respecting man who is "as good as the next one" would seem to be by that "conspicuous leisure" which is obtained, not in the ordinary way of working, earning, and then buying, but by not working—by walking out of the mine at two o'clock while some other chap is so

much a dub of a worker that, in order to make a living, he has to stay in till the day is ended at four!

15. *Effect of the Group in Industry*

E. D. SMITH, *Psychology for Executives*, 168-172 (Harper & Bros., 1928); reprinted by permission

A company for years had worked to reduce the amount of unemployment among its employees. Among other measures, when work was slack in one department the surplus employees were, as far as possible, transferred to some other department where work was available. The transferred employees were paid their full regular wage or average piecework earnings. In the fall, in a department where eight or nine months were required to train operatives, a crew of about twenty girls had been hired to undergo training for an expected spring rush. At the end of the year, when these girls were only partly trained, a shortage of work occurred. The management decided that in giving out what little regular work there was in the department, preference should be given to the group of apprentices so that their training would not be interrupted. Consequently, as work grew less, it became necessary to transfer long-service employees while the apprentices remained on their own jobs. Unfortunately, the first girl to be transferred was one who had had twenty-five years of service. Unfortunately also, when she was told of the temporary transfer no explanation was made of why the junior girls were not transferred also.

The woman went to the department of transfer without complaint. On her arrival, one of the older women there exclaimed: "You transferred, Sadie? With your twenty-five years of service? They must be very flat in Department J." The transferred employee said that there was work enough for all the younger girls, none of whom had been transferred. On finding a sympathetic listener, she began to feel that she had been wronged. During the lunch hour she told the story to one of the older girls in her own department and met the same response. Soon the story was going the rounds of the department, striking up an unfailing sense of sympathy and outrage among the long-service people there. All of them felt a sense of injury to themselves. The imagined wrong to one "old-timer" became the symbol of injustice to all long-service employees. Her rights symbolized the rights of the group. Soon these employees were speaking of the incident in such phrases as: "Doesn't service count for anything here?" "So twenty-five years of devotion is to be a reason for being thrown out first!" "Think how this will affect the reputation of the company in the

town!" Because all the older workers who made up the group had the same point of view, the overwrought statement of the situation did not come in contact with denial. No one stopped to look into the situation and see if it had some valid reason. No one brought to mind the fact that the woman was transferred at full pay instead of being laid off without any pay at all. Any person who had such thoughts was left out of the excited circle.

The next day the situation in the department was tense. The incident which had aroused the crowd spirit stimulated besides the desire that this twenty-five-year-service employee be returned to her regular work, the broader desires of the long-service employees for respect and consideration from the management. As so often happens, the stimulation of a particular desire resulted in stimulation of deep fundamental urges. Consequently, the group had become freshly sensitive concerning the entire conduct of the management in regard to them. Trivial incidents were magnified into serious and deliberate abuse of the rights of the older employees. Every little imperfection in the way the work came to the girls, the slightest delay at the dispatch board in giving out jobs to long-service employees, every minor difficulty of whatever kind, caused disproportionate irritation. Moreover, the foreman, who was a young man with short service with the company, was denounced as "indifferent," "inconsiderate," "uppish." Nothing he did was right. To oppose him was taken as equivalent to insuring better treatment. Try as he might to be tactful, his very presence was a source of irritation. He symbolized to these women the usurpation by youth of the rights of long-service employees.

Finally, the situation became so extreme that intervention by the higher management was necessary. The tactics of these workers was checkmating the efforts of the foreman in all directions. Production was falling off and the department becoming disorganized. The manager called in four or five of the most influential women in the group. With considerable difficulty he finally traced his way back through the maze of trivial complaints which these women made until they told him the incident from which the disturbance had originated. With difficulty, also, the attention of the employees was held on the facts of the case and prevented from relapsing upon their general sense of wrong long enough for them to be brought to understand the reasons for the action taken. When the true reasons were understood, when the management confessed its error in not explaining the situation in advance to the long-service people who were transferred, and when they made clear the company's policy of consideration for long-service employees, the common fear which underlay this outburst of feeling was dis-

pelled. The transfer of the long-service worker was no longer looked on as symbolic, but as an individual incident. As such, the incident was readily accepted as merely an oversight. The storm thus blew over as rapidly as it had gathered.

It was long, however, before the antipathy to the young foreman entirely died out. The habits and feelings built up in times of crowd excitement often long survive the crowd spirit from which they spring. After the incident is apparently over, the suspicions, dislikes and undesirable habits to which it gave rise live on to disturb peaceful industrial relations. Moreover, the channels to the crowd attitude have become well worn. When in the future some incident disturbs the same group, the crowd spirit will arise with speed and intensity. The old phrases of rights and wrongs will reappear and regain their potency. Even the old incident may be reopened. It is out of this survival of habits formed under crowd influences that the greatest evils of excited crowds often result.

C. The Control of Morale

16. *Work Failures—Their Study and Treatment*

V. V. ANDERSON, *Psychiatry in Industry*, 8-13 (Harper & Bros., 1929); reprinted by permission

About 20 per cent of the employees of mercantile establishments —and this is probably true of other business and industrial organizations—are what may be called "problem" individuals. That is, as personnel material they are either liabilities or potential liabilities to the business man. It is from this group that are drawn the repeated transfers from job to job, or resignations, or lay-offs. These are the work failures that in the majority of cases are a drag on any organization.

As the employer sees these individuals they are production problems, or chronic health problems, or chronic attendance problems, or serious attitude problems, or marked disciplinary cases, and the like, and from his viewpoint he is better off without them.

As the psychiatrist sees them they all present distinguishing physical and mental characteristics that underlie and explain not only their job maladjustments, but faulty adjustive efforts and failures in other life situations. In studying the life histories of these individuals, and analyzing their careers, he is impressed with three outstanding causative factors commonly underlying work failure—(*a*) A maladjusted personality; (*b*) specialized job disabilities; (*c*) faulty physical conditions.

Of course, such cases can be dumped wholesale into the com-

munity to shift for themselves. This might, after all, be a simple and easy way of solving the entire problem, for it is common enough for the Management to say, "We are not running a charitable institution, why should we feel any responsibility in this matter?"

But there is another viewpoint, and that is the medical and mental hygiene viewpoint—that many of these individuals may, through proper study and treatment, be adjusted and become assets to the employer, thus cutting down turn-over among employees and increasing production efficiency. A few case summaries presented further on in this study demonstrate what can be accomplished in this direction, and as our statistics show, a sufficiently large number of problem cases will improve under psychiatric treatment to make the application of such measures profitable—not only in terms of human salvage—but in terms of dollars and cents.

And then who will say, after all, that business and industry are going to escape the definite social obligations involved in their increasing contribution to that large army of misfits who are bandied about the community from one store to another, or from one industry to another; out of work a large proportion of the time; partly supported by family, or friends, or churches, or social agencies, or institutions—and furnishing the richest possible soil for the development and growth of delinquency, dependency and mental disease—conditions that become the joint burden and responsibility of the community as a whole; conditions often traceable to factors that on the job render the individual an unsatisfactory employee and lead to resignations and lay-offs.

Constructive work here is possible, and results are most gratifying, when one reviews the case records of fairly well adjusted and productive employees who had at one time been a liability to their employers and to their families.

Business responsibility does not lie in the direction of creating facilities for the custodial care of human failures, or for attempted cure of apparently hopeless work maladjustments. But certainly something is to be said in favor of a conscious responsibility on the part of business for the creation of facilities that would provide the early recognition, careful diagnosis, treatment and prevention of factors that later lead to such unfortunate social results, following the lay-off, or resignation, of problem employees. This is an ideal that guides the psychiatric approach to industry—an ideal that is eminently practical, that is founded on good business sense as well as ethical principles. I have been tremendously impressed with the great therapeutic possibilities to be found in a

department store, in connection with psychiatric treatment work of problem employees.

Experience has taught that the best sort of staff for dealing with the varied problems found among workers, consists of a psychiatrist, a psychologist and a psychiatrically trained social worker. The same sort of a working team has proved most successful in other fields, where the problem has been human behavior. The contributions of these three groups—the medical, the social and the psychological—when combined in a well-organized unit, form the ideal grouping and the minimum basis for an adequate program of diagnosis and treatment of work maladjustments among employees.

The methods employed in conducting a complete psychiatric study can, for practical purposes, be roughly classified into the social history, the job behavior study, and the physical and mental examination. These four fields go together to make up a thoroughgoing picture of the whole individual—his behavior to his work and to major life situations, as well as those influences—constitutional, or home, or school, or work—that have contributed most to his career.

The social history includes a health history (both physical and mental); and the family history, with particular reference to present family situations and home problems of an economic, health or psychological nature—discontent, friction, unwholesome atmosphere, impaired family relationships, etc.; educational history, including academic training, specialized vocational equipment or considerable job experience—which in itself provides expertness at work—and finally, the work history—leading the individual to give an account of the nature of his first regular job, his attitude toward the work, the salary he received, the length of time employed at it, his reasons for leaving, the period of idleness before his next job, what its nature was, his mental attitude toward the work, his salary, the length of time he remained employed at it, etc., etc.—bringing him up to the present time. This may give us a splendid picture of his work adjustment, and always throws light upon his personality make-up.

The job adjustment study conducted by the psychiatric social worker includes a descriptive account of the employee's behavior at work and adjustment to his present job, his manner toward customers, associates and supervisors, his interest in and concentration on what he is doing, his speed and accuracy at work, his neatness at work, his ability to perform the task, his selling technique, the impression he makes on others, his initiative, his knowledge of merchandise, his steadiness in keeping at work,

evidence of fatigue, and the result of health problems, or home, attendance and other problems, on his work and value to the department.

This carefully gotten work adjustment history differs fundamentally from the rating scale method so commonly employed, in that it becomes a descriptive account secured by a skilled, well-trained psychiatric worker, of the actual behavior of the individual at work, rather than the subjective interpretation by an untrained rater, of traits and characteristics an employee is judged to possess. This rating method by means of which wholly untrained people size up an employee is full of dangerous possibilities, from the standpoint of the individual worker, as we shall point out later on.

The physical examination should be done with more thoroughness than is customary, in the case of the average patient in a medical clinic, where the concern of the physician is largely with the history of his present illness, the presenting symptoms of the case, and the actual examination of the organ, or organs, affected. In the psychiatric study, the physician at once questions the entire organism—not only in terms of actual organic disease, or functional disorder, but in terms of general tissue, or organ inferiority, or total constitutional defect, and the well-balanced and proper functioning, or impaired functioning of the machine as a whole.

The mental examination is composed of the intelligence and special ability studies, by means of psychological tests, and of the personality investigation, by means of the psychiatric interview.

The psychological method involves the objective and quantitative evaluation of certain measurable mental qualities. It is of enormous aid to the diagnostician, in that it furnishes him accurate and concrete evidence of the capacities of the individual, and enables him to compare the performance of individuals with each other, and with standards obtained from careful studies of large groups. It is, however, limited in practical application to only a few attributes of the mind, and could never of itself constitute a complete mental examination.

The psychiatric investigation is a more comprehensive method, and assesses the constitution and make-up of the entire personality. It is a clinical and dynamic approach that gives due consideration to the main trends in the mental life of the individual—the so-called patterns he has established, his habits and ways of doing things, his attitude towards himself, towards others, and towards life situations in general; his interests; his hopes; his mistakes; his defeats; his fears; the conflicts and complexes, and the driving

forces—emotional and instinctive—in his nature—all these are carefully evaluated as part of the psychiatric technique.

These two aspects of the mental examination are not to be viewed as opposing methods, in the sense that either one can give an adequate presentation of the important issues that must be considered in the mental study of a given case. On the contrary they are to be viewed as two parts of one whole. We should hardly expect the physician to discard his clinical findings in favor of the laboratory tests, or the laboratory tests in favor of the clinical findings. As a matter of fact, both are essential phases of a careful medical inquiry, in the case of any given patient.

17. *Characteristics of a Good Reward*

L. M. GILBRETH, *The Psychology of Management*, 280-281 (The Macmillan Co., 1921)

Rewards, under Scientific Management are—

(*a*) Positive; that is to say, the reward must be a definite, positive gain to the man, and not simply a taking away of some thing which may have been a drawback.

(*b*) Predetermined; that is to say, before the man begins to work it must be determined exactly what reward he is to get for doing the work.

(*c*) Personal; that is, individual, a reward for that particular man for that particular work.

(*d*) Fixed, unchanged. He must get exactly what it has been determined beforehand that he shall get.

(*e*) Assured; that is to say, there must be provision made for this reward before the man begins to work, so that he may be positive that he will get the reward if he does the work. The record of the organization must be that rewards have always been paid in the past, therefore probably will be in the future.

(*f*) The reward must be prompt; that is to say, as soon as the work has been done, the man must get the reward. This promptness applies to the announcement of the reward; that is to say, the man must know at once that he has gotten the reward, and also to the receipt of the reward by the man.

18. *Mental Attitude Effective in Efficiency*

G. A. PENNOCK, "Industrial Research at Hawthorne," *Personnel Journal*, 8:299-301, 303-304, 310 (1930); reprinted by permission of Williams & Wilkins Co.

Six experienced female operators were chosen at random. Their work was the assembly of telephone relays, which consisted of

putting together a coil, armature, contact springs, and insulators in a fixture and securing the parts in position by means of four machine screws. This operation can be done at the rate of about one assembly a minute. A man from the Piece Rates Setting Department was selected to supervise and observe the test.

Five of the girls were to do the actual assembly work, while the sixth was to stock and procure parts for each assembling operator. The nature of the test was carefully explained to these girls and they readily consented to take part in it, although they were shy at the first conference. An invitation to six shop girls to come up to a superintendent's office on the top floor was naturally rather startling. They were assured that the object of the test was to determine the effect of certain changes in working conditions, such as rest periods, mid-morning lunches, and shorter working hours. They were expressly cautioned to work at a comfortable pace, and under no circumstances to try to make a race out of the test. . . .

As a base output, a record was kept for two weeks on each test operator in her regular department and under her regular conditions (without her knowledge) before she was moved to the test room. This constituted the first or base period of the test. We now appreciate that this base period was probably too short. Following this, the girls were moved into the test room where for a period of five weeks no alterations other than the changed locations were made in the conditions of work. There was no appreciable change in output following this move.

For the third period, consisting of eight weeks, the first major variation of the test was introduced. The five girls were placed on a group piece rate salary basis independent of the large group with which they were previously identified. This meant that each girl would earn an amount more nearly in proportion to her individual effort since she was paid with a group of five instead of a group of one hundred.

Following this period, the test group has been taken through twelve periods. . . .

From these tests have come some startling results, startling because they were unexpected as well as because they were sometimes contrary to accepted opinion.

In the first place, there was a gradual yet steady increase in production regardless, to a certain extent, of test conditions imposed. For some operators this increase has run as high as 35 to 50 per cent. And the study has continued too long for us to attribute this increased production to the novelty of being placed under observation. The highest productivity yet reached was

recorded in period 13, during which the operators had a fifteen-minute rest and lunch period in the morning and ten-minute rest period in the afternoon. The lowest period of productivity was the second, which was the first one in the test room with no change from regular working conditions. However, as has been stated, the production in this period was practically the same as the base production.

Now this unexpected and continual upward trend in productivity throughout the periods, even in period number 12 when the girls were put on a full 48-hour week with no rest period or lunch, led us to seek some explanation or analysis. Observation and study suggested three possible factors which might contribute to this condition:

1. Relief from cumulative muscular fatigue.
2. Change in the pay incentive.
3. Improved psychological attitude toward the work.

[Cumulative fatigue could not have accounted for these findings, since the weekly production curves did not reveal any decline, vascular skin reactions were negative, the production curve had been rising for two years, and complete physical examinations checked the health status. Change in method of payment could not have been influential since a control group with the same working conditions and varying only in the basis of pay made gains equal to the experimental group. The rather remarkable results seem, therefore, to have been due mainly to changes in mental attitude. Industrial efficiency in this group appears to be largely a matter of morale, *i.e.*, producing a freer, happier, and more pleasant occupational life.]

The most significant comments from the workers and the ones that were the most unexpected and valuable were those concerning supervision in the old department.

It had been our feeling that the department from which these operators came, viz.: The relay assembly department, was one of our best supervised departments. The Foreman has a good personality and an interest in his employees, and we had assumed, without knowing, that his methods of dealing with people were being used by his section and group chiefs. The Foreman had also, without knowing, made the same assumption.

We were surprised to learn from the test operators that there were supervisors in the department who kept their operators in a constant state of worry and fear. One section chief got his operators into such a state of fear that some of the more timid

ones actually cried if he looked at them continuously for a few minutes. Others occasionally called up to say they were sick rather than face him in the morning after a low output day.

The disclosure of such conditions in one of our departments was disconcerting, and it faced us with a serious problem to be solved.

In connection with the experimental studies, the home environment and outside activities of the test room operators have been carefully studied. Thorough physical examinations have been given periodically, and a record of diet and health practices has been kept. Also pulse-rate, blood pressure, and cardio-vascular skin reaction data have been recorded at various intervals. We shall take time to enumerate here only a few interesting observations obtained from these findings:

1. The amount of sleep has a slight but significant effect upon individual performance.
2. A distinct relationship is apparent between the emotional status or home conditions of the girls and their performance.
3. Total daily productivity is increased by rest periods, and not decreased.
4. Outside influences tend to create either a buoyant or a depressed spirit which is reflected in production.
5. The mental attitude of the operator toward the supervisor and working and home conditions is probably the biggest single factor governing the employee's efficiency.

QUESTIONS

1. Formulate a definition of morale which will do justice to its behavioristic and introspective features.
2. List as many factors as you can which act to produce satisfaction in work. Divide your list as follows: personal characteristics; characteristics of the work; characteristics of the environment.
3. State some labor policies and practices which are not in accord with a right understanding of the psychology of labor. State some policies and practices that are consistent with Thorndike's statement of principles.
4. Criticize the postulation of instincts of workmanship and of trade or barter. What instinctive basis may there be for these activities?

CHAPTER XVI

LABOR UNREST AND STRIKES

Strikes are the most dramatic episodes in industrial pathology. They represent the culmination of forces considered inimical to the persons most directly affected by them. A strike is really a violent quarrel between two groups who have abandoned all attempts to arrive at peaceful and reasonable settlement of disputed issues, and is therefore very much like war in both spirit and operation.

There is little mystery about most strikes, although they often appear to result from very trivial causes. All the facts of the foregoing chapter are pertinent to this one. Anything which contributes to a lowering of morale will, under appropriate conditions and if sufficiently intensified, lead to strikes. In a way, the two conceptions are inseparable. Poor morale is for practical purposes equivalent to a strike "on the job," and an actual strike is simply a token of the collapse of all plant morale.

Pulling in opposite directions is a phenomenon common enough in a modern competitive society, and it is perhaps idle to hope that there can be a complete community of interests in all employee-employer relations; nevertheless, some kind of working compromise has to be achieved if the wheels of industry are to turn at all. The psychology of controversy is an appropriate topic for consideration at this point. Most observers of debates (upon the outcome of which less vital issues depend than in the usual strike) have noted the tendency to battle over a point not for truth's sake but just for the sheer lust of winning. Even scientists often engage in acrimonious disputes on fine theoretical problems because their *amour propre* would suffer if they acknowledged defeat. Similarly many an employer has fought the unions tooth-and-nail not because he was brutal or grasping, but because he wanted to "run his own business as he saw fit."

The existence of strikes should be viewed as an indictment of the management under which they occur. Progressive

leadership makes strikes unnecessary by eliminating all genuine and justified causes of discontent. It is doubtful, on psychological grounds, whether this can be accomplished permanently by forbidding all independent organization among the workers, or by "taking the wind out of the sails" of the unions through welfare work directed toward that end. Greater participation of workmen in management seems to be ininevitable if industrial establishments are to be democratized. If democracy, broadly interpreted, is sound governmentally, there is no reason why it is not sound economically. Wholly apart from logic, the success which has attended those few concerns which have granted their employees some voice in determining managerial policies is evidence of the wisdom of such a step. The chances that the workers will make impossible demands diminish as soon as they can sit on shop, financial, sales, and other committees vested with real authority. As they observe the extremely difficult problems which arise in operating a large organization, they tend to become more tolerant and appreciative of managerial responsibilities. It is much more satisfactory to most of us to attempt to stamp out poverty and fail, than to be told "It can't be done, and what's more, we'll not allow you to try!"

A. Explanation of Strikes

1. *Why Men Strike*

J. J. B. Morgan, "Why Men Strike," *American Journal of Sociology*, 26: 207-11 (1920); reprinted by permission of University of Chicago Press

We hear of nothing but strikes and labor disputes in all sorts of industries. The war no doubt precipitated this state of affairs, but the cause is something more fundamental and deep-seated in the very nature of modern industry. This reason is the fact that *the work of modern tradesmen, craftsmen, and laborers is so specialized, so devoid of intrinsic interest that the workman finds no incentive to work except the pay he receives.* The nature of the daily work of most of the working people absolutely precludes the possibility of their loving the work. Most of them hate it, and how can they help hating a job which means, for instance, that they go through a set of motions (which they learned in a very short time) hundreds of times a day with the prospect of day after day, week after week, year in and year out doing the same thing?

A common notion is that men hate work, that instinctively they are lazy. Such a notion is itself a product of specialization of labor and has no foundation in fact. When such an opinion is expressed what is meant is that the individual does not readily apply himself to the conventional task. From earliest childhood the tendency to activity is repressed. As long as the child is too weak to get off its back, its kicking, waving of arms, cooing, and incessant activity are admired and no one wishes to stop it. When it gets old enough to meddle with things its activity annoys elders and the repression begins. He is penned in a coop so that he cannot dirty the walls or pull off the table covers; he is put into a high chair for the convenience of his elders and strapped so that he will not fall. As he gets older he is taught not to climb trees, not to play as he would like to, not to fight if he is insulted because he must keep clean and be a gentleman. When he gets inquisitive and asks a thousand or more questions he is told to keep quiet. His play must be of a quiet, gentlemanly, grown-up variety. The poor chap has a hard life keeping from doing the things that he would like to do.

The school training is a continuation in the same process. He has to keep very quiet, ask nothing but consistent questions, and absorb information from teacher or books. He must not waste his time studying the things he desires to investigate for they are not important. His elders know what it is important that he learn and he must adhere to their program. When he goes into the world and gets work he is there also taught exactly what he must do and he is disciplined into doing it. *A good workman is one who gets to work on time, does with some signs of vigor what he is told to do, and keeps his mouth shut. He is nothing but a machine,* a machine easier to handle than his steam-driven comrades because he can be given oral directions and can take care of himself. He has the additional faculties of seeing, hearing, smelling, tasting, and touching, which to some employers are valuable. He is capable of more varied reactions than any other machine yet invented; but he has the inconvenient faculty of getting sick or failing to appear on time and is likely to make mistakes.

No human being could possibly be normal and be lazy in the sense of being inactive. The lazy man does things but does not fit into society; he does not do just as others want him to do. A man is less active at certain periods of his life than at others and throughout life more or less time has to be taken for sleep. There are differences in degree of activity above the threshold of laziness. When we think of a lazy man we get the picture of a man lying in bed to an unseemly hour, shirking his work, and really less

active than others. This is due to the fact that the struggle between what he would like to do and what he ought to do keeps him from acting at all. He hates to do the conventional thing and he is drilled against the unconventional so that he dares not do it; hence he does neither. *Laziness is an abnormality resulting from the conflict between desires to act in unconventional ways and fear of the results coupled with a distaste for conventional activity.*

What forces are brought to bear to make a workman constantly do the work he dislikes? At first the child is made to do the thing he dislikes through physical force; later such forces as shame, fear of being different from others, and ambition are brought to bear until finally as the boy becomes a man the economic motive becomes paramount. He learns that if he is to get from life what others do he must get money, and to get money he must fit into the scheme and work as others do. When a man sees that he must work as a machine and actually does it the distastefulness largely disappears. No man can constantly do a really distasteful thing and the distaste remain the same. He becomes adapted to it. If you taste something sour you get at first the full effect of the sourness; if you keep tasting the same sour thing the keenness of the sensation departs and you fail to notice that it is so sour. The fact that the man does the routine job for so long makes him adapt himself to its unpleasantness and he forgets that he dislikes it. The fact remains, however, that it is distasteful and there is nothing in the work itself that induces the man to do it.

This is the asset that labor agitators can always depend upon. The agitator knows that few men love their work, so that when times get a little abnormal and the wages that the men get will not buy as much as they would like, it is an easy matter to get them in a frame of mind where they will be willing to quit. Why do not agitators work with teachers and preachers who are more poorly paid than the ordinary workman? For the simple reason that a large proportion of the people in these classes are in their work because they like it and work for the work's sake; they would sacrifice a great deal before they would quit.

Men are induced to do things through all sorts of external motives, but master-motives must be intrinsic in the work itself if the work is to go on to its best advantage. If the motive for work lies outside the work the least resistance or obstacle will check it, but if the motive is in the work itself the obstacle will only stimulate the individual to increased efforts to overcome the obstacle, and the work will go on as before.

How can men be made to love their work? With conditions as complex as they are the situation cannot be wholly relieved. Men

cannot be left free to do as they choose in a society such as ours. Yet when the truth is understood many improvements can be made. When employers know that attractiveness of work is more important than pay they will take pains to make the work attractive. *Money is not as strong an incentive as it is usually supposed to be.* When that is all a man gets from his work of course he will take any means possible to get all he can. When he works from other motives he will become less vividly conscious of the amount of pay he receives.

The only remedy that will lastingly overcome this social unrest is to make work interesting for all classes from the laborer to the professional man. We must forever get rid of the notion that anything interesting is for that reason either useless or conducive to inefficiency. The old theory of education used to be that the duller, uninteresting subjects were better for the student than the interesting ones because of the disciplinary value of making the student do what he disliked. The modern method, which has proven a better one, is to present the dead subjects in an interesting way. Psychology has shown that the way to do a thing quickly and well is to become intensely interested in it. Why not make work interesting? It can be done and the employer will eventually save by doing it.

If work is to be made interesting the recent stress upon efficiency with its consequent overspecialization will have to be curtailed. To be constantly stressing the quantity and quality of work done is to furnish a superficial external drive. The extra pay that the man gets will at first look large but it will appear less and less, especially when the scheme becomes more widely used and all men get more pay. The incentive will fail and the workmen rebel.

Enough variation must be left in each man's job to kill the monotony.

Each man should be taught about his job in relation to the others so that he will feel that he is a vital part of the organization.

Each man should clearly see a possible route for promotion. If a man is hired as a stoker with a beginning salary of so much, with the promises of periodical raises until a certain point is reached, all incentive for good work is killed in that man. He must be able to see where he could go beyond the stage of being a stoker. It does not matter if the man has but one chance in a thousand of making a certain step, let him know he has that chance and he will inevitably try to be the one.

When we were training our great national army each man was continually told that his job was important in the winning of the war; he was taught to love his job, the distasteful job of drilling.

Besides he was filled with the ambition to do his best because he was shown the proper steps to gain promotion and saw others being promoted through tests of merit. After the signing of the armistice no one felt that he was vitally necessary and to cap this the War Department stopped all promotions. The spirit of the soldiers dropped like lead and it was almost impossible to get anything done. "What is the use since the war is over and I have no chance of any promotion?" was the cry.

All promotions should be based on merit alone and in such a way that every employee is convinced that it is merit alone that counts. Tell him what qualities are used in judging whether a man is to be promoted or not. Frankness on this one subject will work wonders.

Not only should the man be given a square deal but pains should be taken that he knows that he is being fairly treated, not by blatant advertising but by open straightforward organization. An employer may shower gifts upon his men in the way of recreation rooms, extra holidays, bonuses, etc., but if he is not manifestly fair the men will spurn his gifts and believe that he is trying to appease them for having robbed them.

When the workman was an artisan he was interested in the efficiency of the process in which he was engaged and took pride in the handling of his tools. Today the machine is the artisan and the workman the tool, and no intelligent man can take an interest in being an efficient tool. *The present industrial unrest will not cease until the workman is studied as a human organism with the purpose in mind of giving him some interest in his work besides the pay he receives.*

2. *Effects of Repression*

C. H. PARKER, *The Casual Laborer and Other Essays*, 48-49 (Harcourt, Brace and Howe, 1920)

The powerful forces of the working class environment which thwart and balk instinct expression are suggested in the phrases: monotonous work, dirty work, simplified work, mechanized work, the servile place of labor, insecure tenure of the job, hire and fire, winter unemployment, the ever found union of the poor district with the crime district, and the restricted district with prostitution, the open shop, and labor turnover, poverty, the breadlines, the scrap heap, destitution. If we postulate some twenty-odd psychic characters which are present under the laborer's dirty blouse and insistently demand the same gratification that is with painful care planned for the college student, in just what kind of perverted compensations must a laborer indulge to make endurable his existence? A

western hobo tries in a more or less frenzied way to compensate for a general all embracing thwarting of his nature by a wonderful concentration of sublimation activities on the wander instinct. The monotony, indignity, dirt, and sexual apologies of, for instance, the unskilled worker's life bring their definite fixations, their definite irrational inferiority obsessions. The balked laborer follows one of the two described lines of conduct:

First, he either weakens, becomes inefficient, drifts away, loses interest in the quality of his work, drinks, deserts his family, or,

Second, he indulges in a true type-inferiority compensation, and in order to dignify himself, to eliminate for himself his inferiority in his own eyes, he strikes or brings on a strike, he commits violence or he stays on the job and injures machinery, or mutilates the materials; he is fit food for dynamite conspiracies. He is ready to make sabotage a part of his regular habit scheme. His condition is one of mental stress and unfocussed psychic unrest, and could in all accuracy be called a definite industrial psychosis. He is neither wilful, nor responsible, he is suffering from a stereotyped mental disease.

3. *Industrial Unrest*

C. S. MYERS, *Mind and Work* (University of London Press, 1920); reprinted in U. S. by permission of G. P. Putnam's Sons

The present condition of industrial unrest has been widely attributed to the recent war. When the life of a nation is at stake, overstrain is to some extent inevitable; and when "peace" has been signed, the effects of such overstrain cannot fail to manifest themselves. The writer is himself acquainted with the managing director of a factory who, with his works manager, burst into tears when the latter came to him with the news of the armistice. The editor of an important London newspaper complained that his assistants were breaking down one after the other when the strain of warfare was at an end, and were so sensitive that even the mildest rebuke provoked an outburst of emotion. We have ample evidence, from official inquiries, that during the war, the factory workers complained of feeling "stale," "nervy," "done up," "fairly whacked," especially during the earlier years when excessively long hours, with Sunday labour and a large amount of overtime, were so widely adopted. It is now realised that those conditions of work were economically unsound, and that a far greater output would have been—as indeed in the later years of the war it was—secured by the proper regulation of working hours, the dangers of overstrain being correspondingly lessened.

To some extent, as has been just stated, overstrain was inevitable during the war. For all classes were harassed by the demands of military service, by the uncertainties and sorrows inseparable from the battle-field, by the restriction of food and lighting, by the fear of attacks from hostile aeroplanes, etc.

Such overstrain must produce a loss of "higher" control, leading to the short-circuiting of "lower" nervous processes, whereby their energy is wastefully dissipated. Thus arise that irritability, restlessness and insomnia, so characteristic of "neurasthenia." There is a shortage of reserve force: the brain feels tired; headache and weakness of vision are complained of, there is a general loss of muscular tone throughout the body—in the muscles of the blood-vessels, the heart and other visceral organs, as well as in those of the limbs. The function of the viscera are impeded owing to disturbance in the normal impulses passing along the vagus and sympathetic nerves. Those nerves control the organs of "internal secretion," e.g., the adrenal bodies, the thyroid gland, etc. Disturbance of the functions of these glands, as is well known, causes disorder of the emotions; they (and other mental disorders) are also caused by disturbance of the vascular and digestive system. Thus disorders on the bodily side of the organism become reflected in disorders on the mental side.

Far more important, however, is the converse relation which the mental disorders more directly induced by overstrain exert on bodily processes. The failure of the higher intellectual processes results, on the psychical side, in a loss of control over the unpleasant conflicting experiences of the past, the memories of which, through such higher control, have hitherto—it may be unconsciously—been inhibited or repressed from consciousness. Fatigue impairs this inhibition, and bygone conflicts, together with repressed unsatisfied impulses and cravings, are now free to surge forth from the unconscious to which they have been previously banished. Thus the mind becomes tormented with the emotional experiences of the past. These may be either domestic or industrial. On the industrial side, the desires and instincts connected with acquisitiveness, creative construction, self-assertion, etc., which have been so strongly repressed among workers in modern industry and commerce, escape from bondage. Neither over the worries of the past, nor over those of the present, has the self any adequate mastery; and it has no longer the power to view them in proper perspective. They are like restive horses which have escaped from control and bolt away, bearing their driver along with them. The emotional experiences thus engendered are accompanied by over-stimulation of certain organs of internal se-

cretion, exhaustion of which reacts in turn harmfully on the organism. A shortage of psychical, as well as of physical, reserve force arises.

Thus the overstrained person becomes unduly irritable, and sensitive, and lacking in self-confidence. He attaches inordinate importance to trifling lapses of morality on his part or to small injuries received from others. He hugs his fancied or exaggerated sins, grievances, sorrows or disappointments, and is unable to dismiss their worries from his mind.

Nature may come to his aid by subjecting his emotions to the process of "projection." Instead of continuing to reproach himself, he may (quite involuntarily) come to believe that it is others that are speaking ill of him; thus are formed delusions of persecution or suspicion. Another way in which the self may be secured from the effects of undue depreciation and the feeling of inferiority is by the process of "inversion"; undue shyness may become inverted into defiance, cowardice into foolhardiness, the desire for the opposite sex into hatred of it, and so on. Yet another escape from "facing the facts" is offered by "rationalisation," in which the true causes of one's emotional conduct are replaced by reasons which are invented subconsciously but are accepted with full belief that they are genuine explanations and excuses for one's feelings and behaviour.

Such "defense mechanisms," as they have been called, may come into play in any insoluble emotional situation. In some degree they are responsible for the present pathological condition of industrial unrest. Each knowing that he has much to reproach himself for, both employer and employee unconsciously seek to escape from consequent self-depreciation by fixing the blame on the other. In all branches of industry and commerce, both on the side of management and of labour, uncertainty and distrust, irritability and defiance prevail. Output becomes restricted, and a vicious circle is completed by the atmosphere of unrest in turn produced by conscious restriction of output.

Thus unrest arises not so much from merely physical overstrain as from the effects of worries and mental conflicts of all kinds, e.g., the unsatisfactory conditions of modern industrial employment and its failure to satisfy the natural instincts and emotions, which have consequently to be suppressed. Home troubles, dating often from early childhood, become another frequent source of worry. Such worries produce their effect especially when sown on a favourable soil. This soil has been called the "psychopathic disposition"—an innate tendency to mental instability, sensitivity and discontentment, and to erratic mental development.

However provoked, such mental instability provokes industrial unrest, not only general but also individual. The mentally unstable employee is an irritant to his fellows, and a nuisance to the management. His kind is responsible for much of the existing unemployment and labour turnover. Ever restless himself, he is continually being discharged from one job to another as a worthless worker. He becomes more and more unfitted for a normal environment, and finally joins the ranks of the unemployable, the alcoholic, the criminal or the insane.

We now know that, by the timely application of psychotherapeutic measures (based on the recent developments of abnormal psychology), and by a judicious selection of environment, such workers can, like early tuberculous patients, be prevented from going downhill; many of the emotionally unstable can be healed; and many of those with insane "egocentric" tendencies or with defective intelligence can be prevented from becoming a danger to themselves or to society.

It would be absurd, then, to attribute the present industrial unrest merely to the strain of warfare. Such unrest existed, though by many unrecognised, long before the war. It was becoming more intense during the period immediately preceding the war. Employers and employees had by then become definitely solidified into separate groups each imbued with what has been termed its own "herd spirit," each developing purposely or instinctively its own defences, each resolved to defend his own position and to demolish that of the other "herd."

The weapons of defense and attack used in such industrial warfare may be well seen in a comparison of the standpoints of the extremists on the two sides today. The extremist employer, refusing to "face the facts" of modern industrial conditions, insists on keeping labour "in its proper place." He claims the right to deal as he pleases with the men whom he employs. He resents interference from outside sources. He denies any responsibility for the welfare of his workers; their duty being to work, his to pay them wages. If he has been "through the mill" himself, he argues that "what was good enough for me when I was a lad is good enough for you now." He objects to any improvement in education or other social conditions, on the ground that they make the worker more discontented with his lot. He regards labour as inevitable drudgery, and as a commodity purchasable according to the strict laws of supply and demand. His aim is frankly to "score off" it whenever possible, and to break up the trade unions which oppose his unfettered progress at every step. "Let others rise as he has risen" is his motto—and "the devil take the hind-

most." He looks on the trade unions as hostile associations bent on getting for their members as high wages for as little work as possible, and on robbing him of what he considers the just fruits of his enterprise. He argues that if the workers pursue their present policy of restriction in output, he has the same right to restrict their pay and their control over industry. He may long ago have achieved the ideal from which he set out—of making a fortune; his continuance as an employer now being due to an unquenchable thirst for industrial adventure, greater power and fresh conquests.

The extremist employee, armed with "defense mechanisms" against his feelings of inferiority or self-reproach, smarting under injustice, imagined or actual, presents a similarly "impossible" attitude. Why, he asks, should I increase my power of production, if so large a share in the resulting profits goes to the capitalist? Why is it necessary for the capitalist to reap enormous interest on his capital without serious risk, if he is willing to lend money to the State at the rate of 5 per cent? Why should I be in favour of motion study, if it is going to force me into a monotonous routine method of work and to transfer all craft knowledge and skill from my possession to the department of management? What is the use of talking to me of vocational selection, until my "unfit" comrades are secured from unemployment, and until true vocations have been established throughout the world of labour? Does the textile industry, for example, offer a properly organised vocational system, when 50 per cent of the boys who enter it are said to leave it before they reach the age of twenty-two? Do you call the work of a postman or a porter a vocation? What chances are offered in such occupations for escape from a soulless life of unrelieved monotony? Are high productivity, good wages and short hours the ultimate objects of human existence, or should not the worker rather aim at a fuller, more interesting and intellectual life, and at the exercise of the higher duties of citizenship? Is it inevitable that rulers and ruled should continue to exist as two distinct and opposing classes, and that the former should be in a position to skim off from the latter all the cream of leadership and ability in the schools, factories or businesses, for admission into their own class and for desertion from the ranks into which they were born? As a worker, I demand an adequate share in the control of the work in which I am engaged, just as I have a vote in the government of my country. I refuse to remain a mere "hand"; I want to use my brain. Only then am I prepared to consider the application of scientific organisation and management. Before this can be done, the whole social fabric needs reconstruction.

There is undoubted truth in the positions of both extremists.

In all ranks of society there are men who merely desire to go through life reaping the maximum reward for the least possible effort—men of brute intelligence, working selfishly for their own ends, caring nothing and indeed incapable of appreciating the needs and the position of others. Alike among employers and among trade unions there are some who have shown an unreasonable spirit of narrow-mindedness and selfishness. But in many instances this has arisen largely from avoidable mismanagement and misunderstanding in the past, from efforts to protect their weaker comrades or to preserve the existence of their own "herd." The question is, how far will it disappear with the spread of higher morality, increased responsibility, improved education and the advancement of science?

4. *Analysis of a Great Strike*

THE INTERCHURCH WORLD MOVEMENT COMMISSION OF INQUIRY, *Report on the Steel Strike of 1919*, 246-251 (Harcourt, Brace and Howe, 1920)

1. The fundamental grievances were found to be:
   a. Excessive hours.
   b. The "boss system."
   c. No right to organize or to representation.
2. The remedies desired were:
   a. Shorter day and week with a living wage.
   b. Representation and conference, and an end to the "boss system" which so often subjects common labor to petty tyrannies.
   c. Right to unionize and a substitution of industrial democracy for industrial autocracy.
3. These grievances were of long standing, but had found no expression because:
   a. They were limited largely to foreigners of many races and languages without industrial tradition, education or leadership to organize.
   b. Race prejudice effectually kept the more skilled, more intelligent and better paid American workmen from taking up the cause of the foreign-speaking workmen.
   c. Labor unions have been accustomed to look upon the foreigner as an actual or potential strike breaker.
   d. The steel companies have most effectually deterred men from joining labor organizations.
4. These long-standing grievances were brought to expression by:
   a. The part these workingmen played in the war and the treatment afforded them for the sake of war production

which gave them a new sense of worth and independence.
- b. The fight for democracy and news of a larger workingmen's freedom in their native lands together with a growing sense of real Americanism, which brought a spirit of democracy to their ranks.

5. We found:
   - a. That the strike was regularly conducted in orthodox fashion according to the A. F. of L. rules and principles.
   - b. That while radicals sympathized with the strikers, as was natural, they were effectually debarred by the strike leaders and that far from having influence in it, they often denounced and opposed those who conducted the strike.
6. We find the grievances to have been real:
   - a. The average week of 68.7 hours, the twelve-hour day, whether on a straight twelve-hour shift or on a broken division of 11-13 or 10-14 hours, the unbroken 24-hour work period at the turn of a shift and under payment of skilled labor, are all inhuman.
   - b. It is entirely practicable to put all processes requiring continuous operation on a straight eight-hour basis as is illustrated by the Colorado Fuel and Iron Company. These processes require the services of only a fraction of the workers.
   - c. The "boss system" is bad, the plant organization is military and the control autocratic. The companies' claims, that they accord the right to join unions and the opportunity of conference, are theoretical; neither is allowed in practice.
   - d. The use of "under-cover" men is severely condemned. It breeds distrust, breaks down morals and stimulates ill-will; it is undemocratic and un-American.
   - e. The refusal of the United States Steel Corporation to confer, to accept mediation and its attitude of hauteur as shown by its refusal to follow the recommendations of the War Labor Board incited labor strife and because of the strength and influence of this Corporation, forms one of the greatest obstacles to a just settlement of industrial grievances and unrest at this time.
7. The strike was defeated by:
   - a. The strike-breaking methods of the steel companies and their effective mobilization of public opinion against the strikers through the charges of radicalism, bolshevism, and the closed shop, none of which were justified by the facts; and by the suppression of civil rights.
   - b. The hostility of the press giving biased and colored news

and the silence of both press and pulpit on the actual question of justice involved; which attitudes of press and pulpit helped to break the strikers' morale.

c. Public fear of a general labor war, to the coincidence of the coal strike and threat of the railroad strike, together with labor's failure to formulate and explain its purposes with regard to public service.

d. The prevailing prejudice in the steel towns and in the general public mind and among the English-speaking workingmen against the foreigners who constituted the overwhelming number of the strikers.

e. The ineffective support given the strike by most of the twenty-four affiliated Craft Unions through which it was organized, and by the A. F. of L.

8. Recommendations:

1. The adoption of the eight-hour shift on all continuous processes.
2. Limiting of the day to not more than ten hours on duty, with not more than a six-day and a fifty-four hour week, with at least a minimum comfort wage.
3. Recognition of right to join regular Craft Unions or any other freely chosen form of labor organization; recognition of right to open conference, either through shop committees or union representatives; recognition of right of collective bargaining.
4. A vast extension of house building—by the communities where possible; by the steel companies where community building is inadequate or impossible.
5. That organized labor:

a. Democratize and control the unions, especially in regard to the calling, conduct and settlement of strikes.

b. Reorganize unions with a view of sharing in responsibility for production and in control of production processes; to this end:

(1) Repudiating restriction of production as a doctrine.
(2) Formulating contracts which can be lived up to.
(3) Finding a substitute for the closed shop wherever it is a union practice.

c. Scrupulously avoid all advocates of violence.

d. Accept all possible proffers of publicity and conciliation.

e. Promote Americanization in all possible ways and insist upon an American standard of living for all workingmen.

f. Prepare more adequate technical information for the public in regard to all conditions bearing upon the calling and the conduct of a strike.
g. Seek alliance and council from the salaried class known as brain workers.

6. That the President's Industrial Conference's plan for standing tribunals of conciliation and publicity be given a fair trial. We believe that the most effective step to be taken for the obtaining of justice in a strike situation is through publicity, conciliation and a voluntary system of arbitration; and as a beginning we recommend the fullest publication of these findings and of our more complete reports.
7. That minimum wage commissions be established and laws enacted providing for an American standard of living through the labor of the natural bread-winner permitting the mother to keep up a good home and the children to obtain at least a high school education.
8. That the Federal Government investigate the relations of Federal authorities to private corporations' "under-cover" men and to "labor detective agencies."
9. That the eight-hour day be accepted by labor, capital and the public as the immediate goal for the working day and that government provide by law against working days that bring over-fatigue and deprive the individual, his home and his community of that minimum of time which gives him an opportunity to discharge all his obligations as a social being in a democratic society.

We recommend to the press that it free itself of the all too well founded charge of bias, favoring capital as against labor and redeem its power as a promoter of truth and a formulator of public opinion by searching out all the facts in regard to industrial questions and publishing them without fear or favor.

We plead with the pulpit that it be diligent to discharge its legitimate prophetic rôle as an advocate of justice, righteousness and humanity in all such conflicts of human interest as those involved in industrial strife.

We condemn unsparingly those authorities who suspended the right of free speech and peaceful assemblage before, during and after the steel strike.

We recommend that the Industrial Department of the Interchurch World Movement and the Social Service Commission of the Federal Council of Churches continue this type of impartial investigation of industrial strife and unrest and extend it to studies

of general conditions in industry affecting the life, peace, and welfare of all concerned and that their findings be published as a means of enlightening public opinion, begetting impartial judgment, and promoting industrial justice and peace.

Conclusion.—All the conditions that caused the steel strike continue to exist. We feel that unless changes are made approximating in some degree the findings here presented, further unrest is inevitable and another strike must come. In the measure that workingmen become intelligent and Americanized, will they refuse to labor under such conditions.

5. *Speeding Up*

B. Muscio, *Lectures on Industrial Psychology*, 39-41 (Dutton, 1920)

In a certain American establishment the "task" method of work and pay was in operation. Task work may be considered as piece work, with this vital difference, that any given task must be performed in a given time. Upon task work a man must work at a definite rate, whereas upon piece work his rate is theoretically dependent upon his inclination. In this American establishment, the workers were paid a bonus of 25 per cent of the ordinary wage rate if they accomplished their tasks in the set times: that is, if the time set for a given job was one hour, the man who finished the job in an hour was given an hour and a quarter's pay. It is natural to suppose that, in these circumstances, the set times were very short; and this was actually so. The task and time setter was paid a bonus based upon the number of workers under his charge who failed to earn their full bonuses. Thus, his efficiency reached 100 per cent when every one of these workers failed to do his task in the times allowed for them. On the other hand, the foreman was paid a bonus based upon the number of workers under him who "made their tasks" in the set times. His efficiency reached 100 per cent when all his workmen "made their tasks." The situation, then, was this: the workman was given a bonus as an incentive to expend intense effort in accomplishing a task in a set time; the foreman was paid "blood money" to drive the man if he became slack; and the task and time setter was also paid "blood money" to set the times so short that "the making of the tasks" involved an expenditure of more than the greatest reasonable amount of energy. It is not difficult to imagine the feelings of the workers in this establishment. It must be added in fairness that this is an extreme instance of speeding up.

6. *Consequences of Neglecting Human Nature*

C. H. PARKER, "The California Casual and His Revolt," *Quarterly Journal of Economics*, 30:110-114 (1915)

Labor history, more than any other subdivision of economic history, seems to be written in terms of impressive events. In August, 1913, in the hop fields of Wheatland, California, such an event took place: an unusual strike, as strange as any in the annals of western labor. Men were killed, the country-side cast into hysteria, the militia called out, and the state was made to realize overnight that San Francisco unionism was not the sum total of her labor problems. . . .

The story of the Wheatland hop pickers' riot is as simple as the facts of it are new and naïve in strike histories. Twenty-eight hundred pickers were camped on a treeless hill which was part of the Durst ranch, the largest single employer of agricultural labor in the state. Some were in tents, some in topless squares of sacking or with piles of straw. Eight small toilets had been erected and four days' use had made them revoltingly filthy. No toilets had been allotted to women. There was no organization for sanitation, no garbage disposal. The temperature during the week of the riot had remained near 105°, and though the wells were a mile from where the men, women, and children were picking and their bags could not be left for fear of theft of the hops, no water was sent into the fields. A lemonade wagon appeared at the end of the week, later found to be a concession granted to a cousin of the ranch owner. Local Wheatland stores were forbidden to send wagons to the camp grounds. It developed in the state investigation that the owner of the ranch received half of the net profits earned by an alleged independent grocery store which had been granted the "grocery concession" and was located in the center of the camp grounds.

An examination of the wage system of this ranch for both the seasons of 1912 and 1913 showed an interesting phenomenon. Each day there existed four possible wage rates. If many hop pickers had drifted in by wagon and train and foot during the previous day, and as a result an unemployed crowd hung about the check window at sunrise, then ninety cents per hundred pounds was hung up as the piece price for hop picking. If there were unemployed still desirous for work even after this wage announcement, and a surplus hung about the window the following morning, it was the custom to lower the wages to eighty-five cents per hundred pounds. Like the immigrant at Ellis Island, the hop picker arrives at the job without a money reserve. The dictator

of the wage policy of this range explained that if the pickers grew disgruntled at either the rate of pay or the average income and drifted away, leaving work checks uncalled for, then the wage scale would be raised to ninety-five cents or even to a dollar. There had been certain days in the past, he said, when a labor exodus had forced the price to as high as $1.10 before the workers would flow in and allow the rate to sink to a more profitable level. In order to counteract any wavering in allegiance to the job, ten per cent of the gross wages was held out by this ranch to be paid to those who remained through the season. The ranch owner argued that this was a real bonus, because so many left before the season was out that they, the deserters, fixed the real average wage; therefore, those who remained to receive the ten per cent were paid just that amount more than the average. . . .

The pickers in August, 1913, were drawn from three sources. About a third came from California towns and cities, men and boys who form the great class of town casuals, and the wives and children from various strata of the middle class. Another third were families from the Sierra foothills, quasi-gypsies, with carts and ramshackle wagons. The final third were the migratories—the pure hobo, or his California exemplar, the "fruit tramp"; Hindus; and a large party of Japanese. There was much old-time California blood in this group, and even if the individuals had come upon evil economic days, their idea of personal dignity and their devotion to certain strange "rights" had remained most positive. They began coming to Wheatland on Tuesday and by Sunday the irritation over the wage scale, the absence of water in the fields, plus the persistent heat and increasing indignity of the camp, had resulted in mass meetings, violent talk, and a general strike.

The ranch owner, a nervous man, was harassed by the rush of work brought on by the too rapidly ripening hops, and indignant at the jeers and catcalls which greeted his appearance near the meetings of the pickers. Confused with a crisis outside his slender social philosophy, he acted true to his tradition and perhaps his type, and called on a sheriff's posse. What industrial relationship had existed was too insecure to stand such a procedure. It disappeared entirely, leaving in control the instincts and vagaries of a mob on the one hand, and great apprehension and inexperience on the other.

As if a stage had been set, the posse arrived in automobiles at the instant when an officially "wanted" strike leader was addressing a mass meeting of excited men, women, and children. After a short and typical period of skirmishing and the minor and major

events of arresting a person under such circumstances, a member of the posse standing outside fired a double-barrelled shot gun over the heads of the crowd, "to sober them," as he explained. Four men were killed, two of the posse and two of the strikers; the posse fled in their automobiles to the county seat, and all that night the roads out of Wheatland were filled with pickers leaving the camp. Eight months later, two hop pickers, proven to be the leaders of the strike and its agitation, were convicted of murder in the first degree and sentenced to life imprisonment. Their appeal for a new trial was denied.

7. *Resolution of Individual Conflicts in the Crowd*

F. H. ALLPORT, *Social Psychology*, 309-312 (Houghton Mifflin, 1924)

In our discussion of social facilitation it was pointed out that the responses of the individual were augmented through the presence of the other crowd members. But the change is not solely in the speed and strength of reactions; there is a qualitative difference as well. In the crowd the individual becomes more drastic and violent in carrying out his prepotent impulses than under other conditions. Extreme measures such as destruction of life and property—measures from which the individual would shrink with abhorrence when acting alone—are employed and regarded as justified. This release of the crowd man from the usual moral restraints forms a special problem to which we must now give attention. Let us begin by considering a typical case.

In a comparatively recent strike of coal miners in a Middle-Western State a mob of armed strikers raided the company's property and seized forty or fifty imported, non-union workmen. The intention was to force them to march ahead of their column exposing them to ridicule and abuse through the streets of the mining settlement. Before they had gone very far, however, the shouts of rage from the strikers became so violent that those marching at the head advised the 'scabs' to fly for their lives. This they did, taking to the fields and woods on either side of the road. One of the strikers fired a shot, and immediately the column broke, pursuing the fugitives in all directions and shooting them down without mercy.

This massacre was an immediate expression of the struggle response unmodified by social considerations. Any object which thwarts movement or which opposes prepotent demands for food and sex, and for the safeguarding of love interests in the family will evoke this sort of struggle. Such were the vital interests of the strikers which they felt were at stake in their industrial con-

flict. And the enemies who were, as they conceived, most active in threatening these interests were the non-union workmen; hence the powerful drive to crush these intruders. We may call this the *egoistic* (*or unsocialized*) drive. It was present in each striker. From the moment the 'scabs' were imported there was in each striker the neural setting to drive them out, or if necessary to destroy them.

But although each individual previous to this incident had felt the desire to attack the intruders, he did not do so. There were two reasons for this. The first was fear, that is, the response of withdrawing from any contemplated act which would cause him still greater suffering through punishment. The second reason, a deeper one, was that he had been taught from infancy to respect the lives and property of others. Even if there could have been no possibility of punishment, it is not likely that any single striker would have murdered one of the non-union men in cold blood. Long-standing habits of respect for others and aversion to acts socially regarded as crimes are too strong for this. We may call this restraining attitude the *socialized drive.*

One phase of early habit formation is of special importance in the present connection. When the child plays with fire, or is otherwise careless with dangerous objects he is likely to be hurt by these objects themselves. He thus learns to withdraw from acts or objects which punish him by the laws of nature. When, however, he lies, steals, destroys property, or injures playmates, his elders play a necessary part in the punishing process. Social law, rather than natural law, will, he soon learns, punish him for these acts. It is an absolute rule that in the early stages of this moral training *other human beings are present and inflict some form of punishment accompanied by reproving words and expressions.* Withdrawal from antisocial acts therefore begins as a prepotent response (withdrawal from pain of chastisement) *conditioned by the presence and reproving behavior of others.* As the child grows older, teachers, playmates, and friends take the place of parents as punishers and inhibiters of antisocial conduct. Finally it is the community at large, and the imaginal consensus of public opinion, which by reproving attitudes forbid the participation in crimes against others. Throughout life, therefore, as in childhood, the real or imagined presence of others and their expressions of disapprobation remain the necessary conditions which restrain us. Inhibition of misconduct toward others is founded upon social disapproval.

In the heightened emotional facilitation of the mob, such as that preceding the massacre of the workmen in our illustration,

the egoistic drive of each individual is brought into the sharpest antagonism to this socialized drive. The struggle for satisfaction of personal needs is pitted against the powerful habit of regard for law and human life. The striker wishes to destroy the non-union worker; yet he does *not* wish to destroy him. Since one cannot both kill and spare at the same time, a point of tension is reached in the crowd at which a slight added stimulus may decide the issue.

The crucial moment arrives when the first gun is fired or the first blow struck. The individual then sees with his own eyes that others are delivering the blow that he longs to deliver, and are thereby expressing, not disapproval of acts of violence, *but the strongest kind of approval.* In the face of this it is impossible still to cling to the imagined disapproval of society at large. The crowd in flesh and blood, a more concrete evidence, is immediately and unthinkingly substituted for public opinion in general. By this stroke the entire support upon which the inhibition of violence had rested is cut away. Social disapproval has been converted before our eyes into social approval. That which had been an inhibition to killing the 'scabs' now becomes a facilitation; an attitude antagonistic to the egoistic drive has become an allied one. The drive to kill or destroy now spends itself in unimpeded fury.

B. The Workers' Attitude

8. *The Job and Its Owner*

ARTHUR POUND, *The Iron Man in Industry*, 142-143 (copyright by Little, Brown & Co., 1922); reprinted by permission

A man will leave his job on strike, for reasons which appear absurd to the calm observer, and yet rage like mad at whoever steps into his shoes. In his calm moments he may subscribe to the theory that every man has a right to work; but he never concedes to anyone else the right to work at a job that he considers his, by reason of recent occupancy and willingness to return under certain conditions.

He who depends upon a job vests himself with a proprietary interest therein. Instincts remaining immune to legal distinctions, he speaks of "my job," when he may be tossed out of it within the hour. No ordinary human ever doubts that he is entitled to the means of life; therefore, the wage-employee instinctively assumes proprietorship over that which is essential to his life. In industrial civilization the job is essential to the common

man. His defense of his job, his reaction against the invader who comes between him and his job, is as instant as his defense of his life, his home, or his woman. His job, indeed, is the first line of home-defense. Job gone, the home is in sore danger; unless another job can be found before the savings go, the home is ruined. Moreover, unless he can keep the job up to standard, he cannot keep his home or himself up to standard. The job is the measure of social fitness, of his standing in the community; by it the common man rises and by it he falls. Hence the apparent anomaly, of a man fighting for that niche in the workaday world which he walked out of, is no anomaly at all. The striker leaves the job, not of his own free will, but impelled by a conviction that the job needs improving. It is still, in his view, his job; but not worth keeping on existing terms except as a last resort, under pressure of necessity. When he strikes, he expects to return.

9. *The Sense of Ownership of Job*

ORDWAY TEAD, *Instincts in Industry*, 68-70 (Houghton Mifflin, 1918)

The activity of this sense of proprietorship is so often manifested in little incidents about a factory that its identity should be established. The writer in a visit through a garment shop came across a young girl who was sitting at a sewing machine crying and sobbing violently. Inquiry revealed the cause of her sorrow to be that "her own" machine had broken down and she was being required in the hour's interval to use another machine in perfect repair and of identical make and capacity. A book bindery in which the work was seasonal undertook to distribute jobs by transferring the girls among the departments. The effort was met at the outset by a strong feeling that the particular process which the girl already knew was "her job," and she neither wanted anybody else's nor wanted anyone to learn hers. When a spinner in a yarn mill was asked to change from some "frames" which she had worked for several years she abruptly left with no explanation. In another factory I had occasion to settle a dispute between the management and the truck-drivers. The management had decided to employ a stable-man to tend the horses and care for the harness. The intention was to cut off at least an hour from the working day of each driver. But objection soon developed because the men wanted to tend "their own" horses, and would trust them to no indifferent "lumper" in the barn. In a large foundry when the management found itself with a strike on its hands, it discovered that the men had all the forges numbered among themselves and each man was definitely assigned by the group as a

whole to one which he had grown accustomed to by years of use. The attempt of a new foreman to transfer the man at "number one forge" to a different work place brought the whole department about his ears and created a perfect storm of resentment. Instances of this sort could be multiplied without number to show the strength of the feeling of "mine and thine," and the part it plays in the detailed running of industry.

10. *Sentiment and Feeling in Behavior*

W. D. Scott, "Changes in Some of Our Conceptions and Practices of Personnel," *Psychological Review*, 27:86-88 (1920)

The folly of treating workers merely as reasoning animals but the wisdom of recognizing the importance of sentiment is strikingly illustrated by the following instance:

The workers in the men's clothing industry, in Chicago, were discontented last spring, because of various conditions in the industry. To reduce this discontent some of the companies increased wages 10 per cent. Company X posted a notice that on July 1, each worker who remained loyal to the firm until June 13, would receive "a special extra pay envelope." This promise failed to change the attitude of the workers. A few weeks after the posting of this notice the drive was on for the sale of Liberty bonds and the President of Company X purchased $34,000 worth of the bonds as a gift to his employees. Each worker was given a coupon good for his share of the $34,000 worth of bonds. The workers manifested no appreciation of this gift. On July 1, each worker received a special extra pay envelope containing a sum of money equal to that which he had received on the second week in May—a typical week. This generosity resulted in expression of discontent among the rank and file of the workers. The President of the company was much disappointed by the failure of his program and called into conference on the subject the local labor leader. I was asked to be present also. The following is the substance of the conversation between the President of Company X and the labor leader:

President X: "I can't understand the lack of appreciation of my men. I gave them $34,000 worth of Liberty bonds and a special extra pay envelope of a full week's wages. The union agreement has now put all the firms on an equal wage basis. Although I did not increase wages 10 per cent for the period preceding the union agreement I have given my men more than any other company by the extra pay envelope and the Liberty bonds. I can't see what more they want."

The Labor Leader: "Yes, Mr. X, you have done all you say and your

people are not contented as the people are at the other houses. They wanted the 10 per cent and felt that they had deserved it."

President X: "No, I did not give them the 10 per cent, but I did give the extra pay envelope and the Liberty bonds which amounted to much more than the 10 per cent."

Labor Leader: "Yes, I have figured it up and you gave them in extra pay and bonds somewhat over $10,000 more than they would have received by the increase they asked. But that is not what they wanted. They do not want the gift of the extra pay envelope and of the bonds but they do want the 10 per cent even if it is less than the extra pay and the bonds. I believe they would be willing to refund the $34,000 worth of bonds if you would give them the $24,000 in what they regard as earned wages."

President X: "Very well, I will gladly make the exchange for I shall thereby gain $10,000."

Labor Leader: "I think the discontent will be greatly reduced by the exchange. I will take it up with the people at once."

The proposition was presented to the workers and was accepted enthusiastically even though it entailed a recognized monetary loss of $10,000. However, it restored their offended pride and left them happy.

The President reasoned as follows:

Major premise: All wage earners prefer the greater to the lesser amount of money.
Minor premise: The extra pay and the bonds is greater than the 10 per cent increase.
Conclusion: Therefore, the workers prefer the bonds and the extra pay.

The experienced labor leader recognized that working people are influenced as much by pride and by sentiment as by the logic of the greater gain. He knew that strikes and demands for more pay and shorter hours are frequently but a defense reaction against offended pride, and that the rational interpretation placed on such action is usually as false as the interpretation of President X upon the actions of his men. The industrial leader who seeks to comprehend and to lead his men today finds little assistance in Aristotle's logic or in any conception that stresses the logical reasoning ability of man. He does, however, receive great assistance from the newer emphasis on the non-rational aspects of human actions.

11. *Some Sources of Dissatisfaction*

WHITING WILLIAMS, *What's on the Worker's Mind?* 282-283, 285, 287 (Scribner, 1920)

Next to this fundamental humanness of us all, wherever we are, the outstanding impression, as I try to marshal the various experi-

ences in single file past the reviewing stand of memory, is certainly this: the most important factor of all in the life of the wage-worker is the job—the daily job. For him the day commences with the breathing of the prayer, "Give us this day our daily job." That is the only way in which the daily bread may be spelled with satisfaction and contentment in a civilization organized for the mass production required for meeting a fast-moving world's immense needs.

It almost makes me shiver with the cold of those February mornings before the great factory gates when I think of the heart-sick dejection, the demoralizing loss of standing as a man, and the paralyzing fear of the bread line which fill the mind and soul of the man who, after days of seeking, has no job and knows not where to find one. This impression has been greatly strengthened by many recent conversations, both with laborers and executives. Some of these latter say that they still recall more vividly than anything else the hours and days and weeks back there twenty or thirty years ago in the foundry or machine shop, spent in the fear that a lay-off might be required by the company's business or that discharging somebody might appear to the foreman as the best way for him to ease his mind from some of his vexations. All that I have seen or heard or felt combines to make me believe that it is impossible to see the world as the worker sees it without looking at it through the eyes of the man to whom the need of the daily bread—together with the need of the daily hope—means the need of the daily job. . . .

It will surely appear natural enough that the next impression which marches in on my memory is that of tiredness and the connection of this tiredness with its unheavenly twin, temper. . . . Tiredness seems to cause earlier temper with hardly greater regularity than temper, with its inner friction, causes earlier tiredness. Happiness, either in the plant or the home, appears to be unthinkable in connection with regular workshifts longer than ten hours at the most. . . .

Whether tiredness and temper—T. & T.—are caused by bad conditions of working or of living, I am convinced that they constitute an explosive which is almost as destructive as the "T.N.T." of warfare in its effects on the firing line of our daily lives and along the larger front of our national safety and development.

12. *The Worker's Point of View*

C. DELISLE BURNS, *The Philosophy of Labour*, 34-39 (Allen & Unwin, Ltd., London, 1925); reprinted by permission

If the worker's point of view were dominant in any society, there would be a transformation of the idea of work and therefore a reorganization in the practice of work. That point of view, however, is reached, not by abstract theory, but through the experience of the majority of workers who are, in all ages, manual workers; and the worker's point of view must therefore be primarily the position of those who work with their hands. But since all forms of human energy are in one sense labour, there will be no opposition between the handworker and the thinker.

The consciousness that a new social order is possible undoubtedly begins as a consciousness of class. The workers, although in fact they are the community, feel themselves to be set over against other persons or groups; and this opposition to others—the natural effect of bitter experience—would prevent their contributing anything great to civilization if it were not accompanied, as it is, by a pride in skill and a keen sense of human fellowship. The class-consciousness of the workers has the same elements of primitiveness and of moral excellence which were in the class consciousness of those who once said: *Noblesse oblige.* The workers, like the aristocracy of an earlier age, begin to feel not only that they have rights because labour made civilization, but also that they have duties because civilization depends for its continuance upon them. The worker's point of view implies that a railwayman, an engineer, a textile worker or a dustman is bound by the honour of his calling. He cannot bring himself to do certain acts, and certain difficult tasks he feels bound to endure. There is pride in it; but that sort of pride is a virtue. Pride in the work one does, and claims to rights on the ground of work performed or still to be undertaken, have always existed. What is new is the consciousness of this spreading through the whole class of manual workers. We must look, then, to the characteristics of manual work itself to discover the meaning of the worker's point of view.

First, there is the sense of the free play of energy in manual labour. This is a well-known psychological fact. The muscular sense is distinct from the sense of touch or sight or smell. It is a feeling of expansiveness, of exaltation of the personality which cannot possibly be derived from reading books or calculating. It is a sense of the body alive. In a modern industrial community those who dominate intellectually are so far separated from the physical contact with the earth and from the muscular experience

of the labour upon which civilization depends that they tend to forget or to underrate the essential characteristics of manual labour.

One can hear in any coalfield the chance words of scorn of the "slacker," the man who cannot "go all out" on a face of coal. Not that the miner despises physical weakness. He is well aware that one man may be less vigorous than another. That is not the point. The slacker is the man who does not bring his muscles into play—whatever muscles he has. He may "slack" in order to get something for nothing—and some men in all classes do—or he may "slack" because of some mysterious theory. The point is that he deliberately does less than proves him a man, and is therefore despised by his fellows. Similarly, the turner or fitter in an engineering shop, or the engine-cleaner, or the locomotive driver, does not in fact go slow or scamp his work as the searcher after increased profits may believe—and the proof of it is that civilization still exists. If the workers were as unwilling as some would have us believe, there would be little enough good steel or machinery, and no trains running to their destinations. But it is often inconvenient to recognize obvious facts—such a fact, for example, as that civilization is borne up by the manual workers. These workers themselves know it. They feel it in the stretch of their muscles and the life of their eyes; and others can know it if they watch the engine-driver or the man at the lathe.

Secondly, the worker's point of view implies the recognition of the social necessity of the work he does. He feels himself a man in his work not merely in his own body, but in the effects of his work upon other men. This is no theoretical economics or hypothesis that labour is the sole source of wealth; it is the simple observation of the dependence of men in society upon the work done for the upkeep of society. Perhaps there are some leisured and cultured persons in our "select" residential districts, who inhabit what is called either bijou or baronial, who really believe that the engine-driver or the dustman does his work without thinking about it. Descartes, that very select philosopher, thought birds were automata; and those who get their ideals and emotions from a lending-library seems to imagine that manual workers are automata. But speak to dustmen or railway-guards or coal-miners, and you will find the sense of the social value of work done very widely appreciated among them. It is almost a physical sense of the unity of the acts which go to make up civilization.

Thirdly, the workers feel companionship with those who work beside them. This is the source of the trade-union spirit. Compare a trade-union shop with one from which the union is ex-

cluded; in the second you will feel the suspicion of each man against his fellows, the continual watchfulness of the atomic individual lest advantage should be taken of him, the strain of isolation. In a union shop, of course, individual hostilities may survive, but in general the workers feel that there is some organization, some method for guarding their interests, and they are, therefore, calmer and more friendly. The results on industry are still insufficiently appreciated, because unions are still conceived both by their members and by outsiders as chiefly associations for opposition or battalions of an army. Here, however, we are concerned with the fellow-feeling which the almost physical sense of contiguity in the workshops has produced. This fellow-feeling is characteristic of manual workers and is not so common among artists or organizers or thinkers; but this very feeling is one of the most valuable elements in social life which is underestimated by those who make their political attitude out of theories. That is why a working-class party introduced a new factor in politics.

It has often been remarked that the British Labour Party arose out of trade unionism, and it still depends upon the trade unions, not only for its funds, but for its vitality. Some lament this, for they think of politics in the old terms of political science and not in the new terms of political psychology. The chief value of the British experience is that a workers' party has come into existence by the pressure of natural impulse among the rank and file of the workers, and not by the creation of theorists. The association of workers conscious of one another as workers is the ground of the characteristic worker's point of view which has been carried from the industrial into the political field by the British Labour Party.

Finally, even workers who do not understand the worker's point of view know very well that manual labour is generally in its essence "mental." No worker thinks of himself as a tool. The engine-cleaner or the weaver at the loom, although his work be repetition, knows that he is using his mind. The workers by hand are also workers by brain, in one sense at least. Indeed, many of those who read other people's books are more "mechanical" in their behaviour than the unlettered shepherd or docker. The manual workers, therefore, may accept fellowship with those whom we do not class as manual workers, such as the painter, the musician and the surgeon, and even with the journalist "driving" his mechanical quill; but that does not involve a submission of the manual workers to superior persons. It should be the admission on each side of the honourable necessity of the work of the other. The worker's point of view involves the admission of all work as in some sense human, and therefore not merely instrumental or manual without

being mental; but it also involves the recognition of a common spirit and impulse between the manual worker and the artist, the writer or the administrator.

C. Conflict and Solution

13. *A Guiding Principle*

G. Stanley Hall, "Psychology and Industry," *Pedagogical Seminary and Journal of Genetic Psychology*, 27:281 (1920)

All great movements of history and pre-history have been products of unrest and of man's struggle to make or find an environment which better suits his nature and his needs. It took the world a long time to learn that religion was made for man and not man for religion. More recently we have been learning that the school was made for the child, and not the child for the school. Today we are in the midst of the same Copernican revolution in industry and are beginning to realize that it was made for the better development of man, and not conversely. It, too, can never be stable until it fits human nature and needs.

14. *The Integration of Conflict*

E. D. Smith, *Psychology for Executives*, 216-218 (Harper & Bros., 1928); reprinted by permission

Among individuals or groups, integration of conflict involves the same steps. But when two people or groups conflict, even though they are parts of a larger organization, the natural impulse is to "fight it out" rather than to join together in the quest of some common solution. Unless both parties to a conflict have been schooled in seeking common solutions, it is difficult to resist the temptation to try to gain their ends by domination. If anyone becomes aggressive, the power of imitation is likely to draw the others into the combat. Consequently in solving conflicts between individuals or groups it is especially difficult to maintain on all sides a desire to work out a common solution.

In standing committees the swift degeneracy of discussion looking toward the determination of policy, from consideration of what is best for the company to matching of wits and influence by the various interests each to get what is best for it with little regard for the whole or the others, is so common an incident as to cause many people to shun committee control as unintelligent and disintegrating. Especially when matters are settled by vote is each member likely to bend his efforts toward influencing the vote fa-

vorably to his narrow interests instead of toward finding out what is best for the general good.

15. *Radicalism and Conservatism*

F. H. ALLPORT, *Social Psychology*, 372-373 (Houghton Mifflin, 1924)

Uncompensated attitudes of inferiority in regard to poverty and obscurity are reflected in the tendency toward political and philosophical radicalism. Here again the cry is against the injustice of the environment; but this time it is an unfair political and economic régime which has robbed the individual of success. Differences of ability are overlooked and all men are considered equal in merit and deserved reward. From this axiom it is deduced that, since some achieve more wealth and power than others, there must be a basic injustice in the social order. Inferiority within the individual himself is obscured by this rationalization. Radicals are thus usually the 'have-nots,' who demand a change in the *entire system of things,* and who believe that the cure for all social ills is to prevent one man from possessing more of this world's goods than another. The type is too familiar to require illustration.

The extreme radical is devoid of knowledge of his own motives and defense reactions. He represses his self-accusations of economic inferiority and projects them under the rationalization of economic persecution. The lack of insight in such individuals is well expressed by the old army saying: "It's a case of everybody out of step but Jim." In personality rating studies a suggestive negative correlation has been found between the trait of radicalism and the possession of insight. That is, there was a tendency for those who were judged as extremely radical to be judged low in insight, and vice versa. This experimental evidence is the more convincing because these two traits are not likely to be confused by raters.

It must be remembered that the radicalism here referred to is not that of movements, but of individuals. Many support radical schemes who are not really radically minded. Moreover radical measures are sometimes justified and needed as solutions for political evils. The behavior described in this section is that which belongs to the radical personality, the individual who is by nature, and regardless of objective justification, a radical. Such as these are generally actuated by a rationalized inferiority conflict.

The extreme conservative, the man whose personality traits incline him to resist all change, also has his conflicts and hypocrisies. He belongs usually to the propertied class. His interests are best

conserved by keeping in effect that regime, however unfair, which enabled him to accumulate and maintain his fortune. He therefore defends the existing scheme upon the grounds of tradition, past experience, and morality. Many of his arguments, like those of the radical, are pure rationalizations. The inferiority conflicts of the radical are, however, of greater import in social conflict than the defense reactions of the conservative. The latter merely clings to a tried system which, in spite of its defects, works after a fashion; the radical seeks, and sometimes accomplishes, a sudden overthrow of the entire political and social organization. Revolution, rather than evolution, is his goal.

16. *Thought and Feeling in Behavior*

WHITING WILLIAMS, *Mainsprings of Men*, 190, 194-196 (Scribner, 1925)

Our intellectual or reasoning processes appear to possess inertia. This inertia requires for its overcoming a certain amount of time.

Our emotional processes, on the other hand, are evidently affected much less by inertia than by intensity. This intensity subjects the leader not so much to the test of time as to the test of crisis. . . .

Of all these great moments the action remains beyond our understanding except as we see the ties which bind the actor to his audience—his accepted audience. He simply dares not lose thought of his continued standing with his adopted group of witnesses. At such a moment, accordingly, all the powers of his soul's life drive him toward loyalty to his associates. If that means disloyalty to others—well, it can't be helped. Never at such times, however, does the choice appear to its maker to be between loyalty and disloyalty: always is it a question of "*Which* loyalty?"

"The strike came just as I was within six months of my pension," the white-haired and wrinkled railway machinist related. "So if I went out with the boys, I not only lost my job, but also the comfortable old age my wife and I had dreamed of for years. Besides, I knew the bosses here would call me turn-coat—though I've known 'em for years—and loved 'em, too! Still, if I stayed on the job, the boys would paint my house yellow, threaten my wife—and my sons would have to stop railroadin'—or change their names! It was terrible!"

"We stand ready to take any honorable way of avoiding industrial warfare," the leader of Britain's striking coal-miners added, a few years ago (1921), after he had issued his ultimatum that no solution could be considered which did not increase the miner's daily wages.

Exactly the same word "honorable" was used by the public's

representative when he took his final stand that no agreement would be acceptable which did not increase the miner's daily output. The moment the issue is thus drawn, it is idle to ask either of such leaders to "be reasonable, back down, and acknowledge that the arguments presented have convinced you!" When each defined the final limits of his honor, he names the ties which bound him to his group. With that, liberty went out of his hands. Only his honor could set him free: if that were not to be saved by victory at the conference-table, then only one other possibility remained—the field of battle; for that is the one place in all the world where even defeat will save it. To each of them, the surrender of his ultimate demand at the table means that all further possibility of leadership with his group is gone—and gone forever. To each of such leaders, therefore, the saving of his face is, must be—yes, and *ought* to be!—more important than the mere gaining of a peace. To each of them the responsibilities of his leadership mean that he simply dare have no thought of accepting those arguments of his opponents which merely convince *him*—they must also convince *his constituents,* and hardest of all, convince them in the heat of the crisis. In such a case, the only alternatives worth considering are those by which the honor of both representatives may be saved—in this case the agreement of the mine-owners to pay higher wages *on condition that* the mine-workers give larger tonnage.

"If you insist on your demand," a railway head protested, "then we must fight, though, personally, I think your request is proper. But you leaders know that you mustn't get too far ahead of your crowd. Well, neither can I. So what we've got to do is to find a compromise which not only satisfies all of us, but also the people behind us."

17. *The Irrational Factor in Human Behavior*

ELTON MAYO, "The Irrational Factor in Human Behavior," *Annals of the American Academy of Political and Social Science,* 110:117-121 (1923)

If some inorganic material prove obdurate to industrial process, we employ chemist and physicist to discover why. But should the human material of industry prove obdurate to factory organization, we usually lose our tempers and stamp about breathing forth threatenings and slaughters. In the one case we endeavor, with careful patience, to discover what unknown causes defeat our purpose. In the other case we appeal all too often to primitive force, talking darkly of conspiracy the while. It is a strange inconsistency. We have long since ceased to smash inanimate things

when they happen to displease us. But we still apply the primitive method to our brother man.

We do not, of course, always handle human situations so crudely. If the problem is serious, or the stress sufficiently great, we abjure the luxury of anger. During the war, for example, the Allies developed excellent methods of insuring a high morale in the fighting-line and factory. Military leaders speedily discovered that "shell-shock" was a mental condition that required medical treatment rather than punishment. It was not due to cowardice but was the inevitable effect of abnormal living conditions, overstrain and fatigue. In one classic instance it was discovered that there were more military decorations in the "shell-shock" ward of a hospital than in any other ward.

Industry's Failure to Utilize Human Sciences.—But in spite of this really notable discovery of the need to investigate human situations, industry has very generally failed to take to heart the lesson of the war. Defective or mistaken factory organization may be just as effective as war in giving rise to overstrain, fatigue or manifestations of abnormality. There is, of course, less sense of imminent personal danger in industry; but economic fears of another type may be as urgent and overstrain and fatigue conceivably greater. This last claim must be conceded when it is realized that in industry, so far as the individual is concerned, we may be dealing with a twenty-year accumulation of fatigue and disgust and not merely with a two or three-year period. The situation is further obscured by the fact that the conditions of military discipline, being rigid, serve to force mental abnormality into the open. A soldier who is overcome by fatigue, disgust and fear cannot quit his job and look for another in the preliminary stages of his disorder. Discipline compels him to hold on until an obviously neurotic condition supervenes and he is ordered medical attention. Industry is not so fortunate; it is always possible for a worker to conceal his real ill from himself and from his employers by "desertion." His "desertion" anticipates a "nervous breakdown" and consequently hides the fact that a high "labor turnover" in a particular trade has discoverable causes which remain unknown. This fact I propose subsequently to illustrate.

At this early stage of the discussion it is necessary for me to guard myself from suspicion of prejudging the issue. My claim is not that a high labor turnover or other symptom of industrial discontent is invariably caused by overstrain or fatigue or any other such single or simple cause. What I would point out is rather that when men are "difficult" or "unreasonable" there is always a cause. This cause is usually complex, it is always unknown

both to employers and employed; but it is discoverable. A high labor turnover, or a strike, is primarily a social and industrial ill; the former is a chronic malady, the latter an acute one. In either case, the prime necessity is diagnosis and treatment, investigation and remedy. Once this attitude is generally adopted, we shall hear less of unrest and subterranean conspiracies; there will be less conflict and more progress. That there are underlying and unknown human factors in the situation is true beyond all doubt. But these factors are not, to any extent that matters, of the nature of subtly conceived conspiracies. This applies to both sides in the controversy. "Capitalist" and "Bolshevist" conspiracies exist mainly in the minds of those who bring fear and anger to bear upon the problem, rather than dispassioned thought. Diabolism is chiefly a bogey created by the terrors which still lie near the surface in civilized thinking.

Labor's Failure to Understand Its Own Ills.—The caution I have voiced with respect to prejudging the issue must be applied not only to the possible causes I have named but also to the desire for higher wages or more money, which is usually given as the cause of labor unrest. Workers themselves frequently diagnose their ill thus; their employers and society at large generally accept the diagnosis. That the desire for more wages plays some part in the situation must be admitted. But there are good reasons for doubting whether it is the only, or even the most important factor. Demands for higher wages are constantly made the world over. Yet in many industries it has been found that the majority of workers refuse to earn more than a certain total income. This applies equally to miners and to insurance agents in charge of a district. Once his total earnings reach a certain sum, the average individual prefers to limit his work rather than to increase his income. It would appear, therefore, that the desire for increased financial resources achieves satiety relatively quickly. But this satiety, when achieved, does little or nothing to abolish labor unrest. A labor situation I was once asked to investigate in an American factory provides an excellent illustration of my point. The employers were of a most enlightened and humane type; the factory was exceedingly well organized and successful from the standpoint either of production or of morale. Four financial "incentive" schemes were in operation and were working well. The labor turnover in the majority of departments was low, about 5 or 6 per cent; but in one department the turnover was excessively high. "Efficiency" experts had been consulted but in vain; every year at least one hundred hands were taken on in order to keep approximately forty working. With the detailed problem that revealed itself, I shall deal subsequently. It suffices here to point out the definite limitations of

the "financial incentive" plan. Given that more-fundamental difficulties exist, the mere application of financial incentives to stabilize turnover or to improve quality of work is futile. A thoroughgoing investigation is needed, and in every instance, before an employer can be sure that financial remedies will avail him anything. The initiation of incentives of this type is frequently the outcome of ignorance and despair: "we don't know what's wrong; let's try an increase of wages." The situation in the Australian sugar industry provides another probable illustration of the same difficulty. Some years ago the colored Kanaka laborer was abolished in deference to the "White Australia" policy. White laborers took the place of the colored man in the sugar fields—without any investigation of the physiological or psychological effect upon the white man of work beneath a tropical sun. Since that time the sugar industry has been incessantly disorganized by strikes. These strikes are usually accompanied by a request for higher wages, in spite of the fact that satiety has already shown itself in the form of a tendency to desultory working. This again suggests that the concentration of employers, and employes and arbitration courts upon the wages question is mistaken. What is probably wanted is knowledge that none of the interested parties and arbitrators in conference possess, namely, knowledge of the ideal conditions of work for white men in the tropics. It would seem that no wage-rate, however high, can possibly bring content to the worker until the revelant physiological and psychological facts are made the basis of the industrial plan.

Diagnosis by Science versus Diagnosis by Discussion.—These considerations make one doubtful also of the ultimate value of Whiteley Councils, the "Plumb plan" or, generally, the principle of democratic control in industry. Recently I was fortunate enough to be present at a discussion of the value of industrial councils on which management and employes are both represented. The discussion occurred at a conference of some twenty employers and high business executives. The opinion seemed to be unanimously in favor of such councils and one had no difficulty in recognizing and admitting the excellence of the achievements claimed. In one case an employer of over seven thousand persons pointed out the educative effect upon himself and his colleagues of a direct acquaintance with the problems of the employe and with the worker's point of view. Any means which will tend to interest the worker more directly in his work, which will tend to give back to the worker something of the economic freedom and autonomy of which the industrial revolution deprived him—anything of this sort is not merely excellent, it is also necessary. I do not wish to deny the enormous value of representatives councils

considered from these two standpoints. It is when this form of council is proposed as a sufficient remedy for labor unrest that one cannot but be doubtful. In the majority of instances of high turnover or definite unrest, the worker has as little notion of the real ill he suffers as an individual afflicted with melancholia or a nervous breakdown. To put the matter in extreme form, it seems that conference between ignoramuses is as little likely as is conflict to provide a real solution of the problem. This is, of course, an over-statement; but I make it deliberately in order to call attention to an aspect of the situation which is unduly neglected. If an individual is afflicted with typhoid fever we do not call a conference of his relatives and a few representative politicians in order to decide, in a carefully democratic fashion, what shall be done. We send for a physician, arrange for a blood-test, and expect the man of skill to prescribe such treatment as is required. The two cases are not exactly parallel, but the analogy will serve to indicate how large a part is played by ignorance in our methods of handling labor unrest. In the average instance, labor unrest would be easy to handle if the worker knew what was really wrong. The fact that no one knows the cause and that no one adopts the proper method of discovering it—these are the considerations that urge us to look over the possibilities of psychological investigation. . . .

Importance of Understanding the "Total Situation".—So also with industry or business. We cannot argue from "instincts" or "urges" or "motives" to industrial problems. These names no doubt denote aspects of the individual human, but they do not include the man; they remain merely aspects. To confine ourselves to such studies would mean that we had excluded the human factor in industry, that is to say, the man himself, from proper consideration. The failure which often attends the application of financial incentives to the solution of problems of labor unrest provides a practical illustration of this fallacy. Our study must begin with the individual and not with classified motives or categories to which we have arbitrarily reduced him. To put the matter in a word, we may say that the study of "total situation" is fundamental in all applications of psychology. This is as true for the factory as it is for the psychiatric clinic; only when we have investigated the total situation of an individual can we know why he dislikes all foremen or believes himself to stand in special danger from falling meteorites.

Now the phrase "total situation," used as a technicality of psychology, may sound alarming. It is not really so; all that it means is that the "setting" or background of a thought or thing counts for as much as the thought or thing itself. If a suburban

hostess were to walk into her drawing-room clad only in a "one-piece" bathing costume her visitors would think her insufficiently dressed and would probably conclude that she was mentally disordered. They would draw no such conclusion upon the summer beaches; yet the only difference between the two situations is a difference of background or "setting." It is not so much the thing we see that determines our thought, it is rather the background against which we see it. And for every individual this background is different. Although in actual fact the same for everyone, the world about us is nevertheless interpreted by each of us in the light of his past life and previous experience.

18. *Industrial Conflict*

F. H. Allport, *Social Psychology*, 411-414 (Houghton Mifflin, 1924)

The recent wave of industrial conflict in this country provides instructive material for the student of social behavior. The full reason for this epidemic of strikes and labor agitation is by no means clear. The condition of laborers and trade-workers has been on the whole better in recent years than ever before. The war brought an era of high wages and better living conditions which seem to have remained fairly stable ever since. Psychological causes, other than those resulting from the oppression of the worker, must be sought to explain the prevailing unrest. The rise of unions and the principle of collective bargaining have given laborers a power which they have never before felt. This actual power of unions is increased psychologically through the impression of universality (consciousness in each worker of the strength of his organization). With the impression of large numbers there comes also the belief in the supreme justice of demands made by these great bodies. Control through these crowd mechanisms has been widely exercised by agitators both in assembled crowds and through radical literature.

Another cause seems equally significant in modern industrial conflict. Labor unions are not only weapons for concerted economic struggle; they are defenses organized against the imputation of inferiority. Under the influence of the Russian revolution, a movement growing out of age-old class distinction and oppression of the proletariat, American laborers sought to relieve their minds of the unpleasant consciousness of inferiority. This they did by projecting upon the capitalistic class the charge of oppression and the intent to keep them (the workers) in a state of social and economic slavery. It is true, of course, that their charge of unfair distribution of wealth is partly justified. But the sweeping and

exaggerated claims made by radical leaders show that the economic drive is not the basic motive. Thwarting of the domestic and economic life is a *rationalized* cause for class hatred. It is more satisfactory to the I. W. W. member to ascribe his humble status to the injustice of capital than to his personal incompetence. He must hate capitalists accordingly, and must organize a concerted movement against them.

Various other straws point in the same direction. Coupled with the outcry against inequalities in the award of profits is the assertion that one man is entitled to as great a share as another. Labor as a whole is indispensable. It has great power as well as dignity. Each laborer should therefore participate equally with the capitalist and manager. By arguments of this sort individual differences of education, native ability, and enterprise are glossed over. Another indication of inferiority conflict is the attempt to equalize the status of labor with that of professional and executive work. The trades mechanic asserts that the doctor or lawyer 'gets paid for his brains' rather than for his time; so why should not *he* demand the same? He implies that, since brains are the basis of the claim to salary, there should be equal remuneration in the two cases. The fact that brains may differ in value is not allowed to enter the discussion. Regulations also of unions regarding apprenticeship aim toward the elevation of the trade in question. The rule that a helper must always accompany the expert mechanic, while no doubt serving objectively useful purposes, also increases the self-esteem of the expert. Like the professional man he too must have his assistant. There has recently arisen a somewhat affected independence in the skilled and domestic trades regarding wages, hours, and readiness to serve. This attitude is a part of the general protest against possible imputation of inferior social status. It is reinforced and directed toward social control through the crowd factors in trade unionism.

What is the remedy for this unfortunate situation? The cure for all conflict lies in insight. The manual worker must realize that labor does not have to be protected against the slurs of those who do not have to work, but that it has *by its own merit* sufficient proof against such slurs. Nature has not made men equal in ability. Some merit greater remuneration than others because they make possible such rewards by rendering a rarer and more vital service to society, a service which can be given only by high capacity together with professional training. Further than this fact no inferiority exists in the status of the working man; and certainly no disgrace attaches to that status. Industrial workers must be brought to face these facts squarely. They must realize that no

one is charging them with inferiority *except themselves;* and further, that much of their outcry against 'economic oppression' is a futile attempt to ward off this self-originated accusation and to escape the facts. If the worker is thus fated to remain at a modest economic and vocational level, vicarious compensations should be sought in avocational interests, wise employment of leisure and pleasures of home life. It is true that such compensations would require more favorable hours of work and better wages than some employers are willing to give. This, therefore, is the obligation which rests upon the capitalist and industrial manager. Employers must assume their share of the problem by enabling the worker to find outlets in useful and pleasureable channels for the drives which are thwarted by his limited vocational status.

Owners, directors, and managers cannot escape their duty in the resolution of the conflict of inferiority in the worker's mind. Huge profits, displays of wealth, emphasis upon differences of education and culture as though these were the natural heritage of the rich, all tend toward increasing both the worker's feeling of inferiority and the hatred through which his envy is rationalized. To abolish provocation for this caste feeling would be one of the greatest services which the capitalist and employer could render to the cause of industrial harmony. . . .

To state the matter in another way, big business should be administered with two purposes instead of one. These two purposes are profit making and social adjustment. Neither of them should be sacrificed wholly to the other, but both should be kept in view. There is no argument to justify unlimited acquisition of wealth or unrestricted return for capital or ability. *Laissez faire,* right to buy in the lowest market and sell in the highest, privilege of employing, paying and discharging as one pleases, are not natural and sacred rights of mankind. They are merely useful assumptions which may become rationalizations for greed. The capitalist stresses the justice of his scheme just as the socialist preaches the justice of the confiscation of capital. In the same manner both sides in the late war prayed to the same God, and each demanded from Him the right to victory. There is no abstract or absolute Right which can be evoked to justify either side. The immediate personal needs of human beings sweep aside these rationalized fictions. Power for social control brings with it the obligation to exercise that power wisely and well. Corporations, therefore, which control the livelihood and destinies of thousands must face the responsibility of so ordering that control as to satisfy the needs of human life and bring contentment to their workers.

QUESTIONS

1. Is political radicalism necessarily associated with the causes of industrial strikes?
2. How do you account for the so-called proprietary interest of the workman in his job?
3. Are higher wages and shorter hours invariably the real motives for striking? What other influences frequently play a part?
4. State points of view that are different from the worker's point of view. What is the worker's point of view?
5. How would you explain in psychological terms the cause of the Wheatland hop pickers' strike?
6. Is the assumption of universal rationality and self-interest an adequate basis for interpreting industrial relations? Why?

CHAPTER XVII

LEADERSHIP AND SOCIAL ADJUSTMENT

Up to this point the discussions of this volume have centered around the mind of the individual workman. In this chapter we turn instead to an examination of the mentality of the leaders of industry. This does not imply, to put it bluntly, that there is one kind of psychology dealing with the laborer and another kind appropriate only to business rulers. On the contrary, there is only one type of psychology just as there is only one variety of astronomy—viz., that which deals with the general mental properties of the human being as such, independently of all adventitious differences in rank and power. The laws of association function alike in the brains of the corporation president and the humblest porter.

Leadership is normally vested in the management of any organization. This does not mean that the ultimate objectives of the corporation are determined by the management. The stockholders universally decree that the major goal of the concern shall be more profits for distribution; consequently, in a society where financial motives are dominant, engineering and social considerations become secondary. The leadership functions of contemporary management are therefore restricted to the organization of programs which will best allay the cry of "more dividends!" Psychologists, as psychologists, have no quarrel with such a situation, because it so happens that the enlightened procedures set forth in the earlier sections of this book actually contribute to the attainment of this goal by developing a more efficient program of work and building up a more competent and satisfied body of employees.

Managerial heads have in the past been chosen from men with a great diversity of background, but within recent years there has been a marked tendency to limit that choice to trained technical men. The chances that an engineer, regardless of what branch of the profession he may have practiced, will at some time be called upon to assume executive duties have

steadily increased. It is important that the qualities of successful leaders be known, first, in order to select persons possessing them more intelligently if the qualities are inherent, and second, in order to develop them more effectively if they are to be learned.

Physically, there is much to support the contention that executives tend to be big men in the sense that they are taller and heavier than the average. Whether this is due to the positive correlation known to exist among desirable traits (e.g., gifted children tend to be physically superior to the normal, despite the superstition fostered by the caricaturists) or whether executives are purposely selected for the effect of their mass upon subordinates is uncertain. Conspicuous skill in leadership is also associated with high intelligence. Most prominent of all, leadership seems to be linked with certain vaguer temperamental or personality traits such as aggressiveness, extroversion, sociality, persuasiveness, prestige, etc. It should be emphasized that the kind of leadership here referred to does not just consist in getting the other fellow to do what you want him to do, but rather in accomplishing ends which are beneficial to both leader and led and to the social group as a whole.

Since the business of leading men is such a necessary and highly esteemed task, it is essential that potential leaders be discovered early and properly equipped for their future duties. The colleges are obviously the source of most leadership material, but it is pathetic how little has been done to foster constructive organizing powers beyond the tacit encouragement of a crude "go-getterism." The engineering schools have been particularly negligent in this respect, and realize it. Most educational institutions acknowledge the necessity for training the whole man, but few are at present provided with the machinery for doing so. There is no reason why revision of one's personality in the light of deliberately chosen values should not be undertaken in the same scientific fashion with which a physician proceeds to build up a patient suffering from incipient tuberculosis.

A. Qualities of Leaders

1. *Intelligence and Business Success*

W. V. Bingham and W. T. Davis, "Intelligence Test Scores and Business Success," *Journal of Applied Psychology*, 8:21-22 (1924)

Most of the business men who served as subjects in this study are far above the average American in general intelligence. Ninety-five per cent of the group have an A or B intelligence rating, indicating how rare it is for a man of only average intelligence to achieve a degree of business success comparable with the success of this group. These men are not only more intelligent, but they are on the whole superior also in business success.

Within this selected group, success in business, as estimated from items on a personal history record, does not correlate with intelligence as measured by a fifteen-minute group test.

The salesmen, as a group, were more proficient upon disarranged sentence questions than were the executives. The executives, on the other hand, were more proficient upon arithmetic and number completion questions. Proficiency on the arithmetic questions shows a negative correlation with schooling beyond grammar school. Proficiency in opposites differentiates the occupational groups not at all, but shows some correlation with schooling.

Business men who make superior test scores are more apt to reply to a personal history questionnaire.

Relative success in business can be estimated only with moderate reliability from data obtained on a typical personal history record form. Better criteria of business success are wanted.

The negative correlation of —0.35, P.E. 0.07 between age and mental test score should not be construed as unambiguous, since the group probably contained a selection of brighter young men and less bright older men.

Possibly some factor of selection may also account, in part, for the interesting correlation between years of schooling and test score: 44, P.E. 0.06. To some degree, the brighter the boy, the longer he tends to stay in school before entering a business career. Schooling does not, however, show a significant correlation with the criterion of business success.

Better criteria of success are required, as well as more severe and thorough intelligence examinations, in order to measure with accuracy the share which mental alertness contributes to accomplishment in business. But the evidence in hand suggests that superiority in intelligence, above a certain minimum, contributes

relatively less to business success than does superiority in several non-intellectual traits of personality.

2. *Scholarship and Salaries*

W. S. GIFFORD, "Does Business Want Scholars?" *Harper's Magazine,* 156:671-674 (1928)

To tell whether high scholarship has a direct relationship to success in business, comprehensive and rigorous evidence is needed. Business itself can most easily collect that evidence. Furthermore, it can hardly afford not to do so. Each year at least half of the 40,000 young men graduating from our colleges are entering its ranks. Their selection and training require an extremely large investment. One of the most readily available objective measures of their past achievement is their college scholastic record. It measures the results in what, after all, has been their major task for four years. Its value for indicating future achievement is surely worth determining.

With this point of view, the personnel department of the American Telephone and Telegraph Company, under the direction of Mr. E. K. Hall, for the past two years has been making such a study of the relation of college scholarship to success in the Bell System. A large part of the study, covering the record of 4,125 of the college graduates in the Bell System from 104 colleges is completed. Additional records from a number of other colleges are expected, but there is no reason to believe that these additional cases will alter materially the general results already obtained. . . .

Of the 4,125 graduates, 319 were at once eliminated from the study because more than half of their business careers had been outside the Bell System. Of the 3,806 included, 1,662 were less than five years out of college, 2,144 were from five to thirty years out. In obtaining these men's records we asked the colleges to classify them in four groups:

1. Those graduating in the first tenth of their class.
2. Those graduating in the first third but not the first tenth.
3. Those graduating in the middle third of their class.
4. Those graduating in the lower third of their class.

Chart I shows the median salaries of these men grouped in accordance with their scholarship rank at college. Each group's median is expressed as a percentage of the median of all the men included in the study. Median salaries, which show the salary of the man in the middle of his group, for example the fiftieth man in a group of ninety-nine, have been used instead of average

salaries, which are sometimes greatly affected by one or two especially high salaries.

As is indicated on Chart I, of the 3,806 men studied, 498 had graduated in the first tenth of their respective classes. By about the fifth year of their employment this group began to earn more than the other college men. They continued to increase their advantage little by little until they were twenty-five years out of college. Then they began to go ahead still more rapidly. The

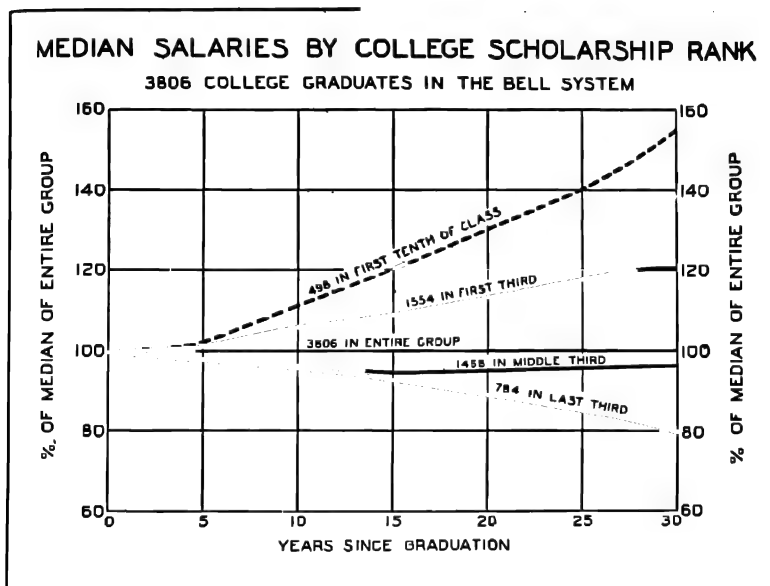



CHART I

SCHOLARSHIP AND SALARIES

line in the chart represents, of course, the median man in the group. Many individuals did better and many poorer than this man, but the group as a whole averaged substantially higher earnings than the rest of the 3,800.

Next to the men who graduated in the first tenth of their classes come those who were in the first third of their classes, including the first tenth, 1,554 men. Their average earnings in the Bell System are also in relation to their scholarship in college. They are lower than the earnings of the men in the first tenth of their classes, but better than any other group. . . .

The 784 men who graduated in the lowest third of their classes

have earned the least, and the curve of the earnings of the median man in this group has exactly the opposite trend to that of the median man in the upper tenth of their classes: the longer the best students are in business, the more rapidly their earnings rise. The longer the poorer students are in business, the slower their earnings rise.

It cannot be stated too emphatically that these lines on the chart represent the averages of the performances of the men in the different groups and that the records of individuals in each group vary very widely from the averages. It is clear, however, that in the Bell System, on the average, men who were good students have done better than those who were not. There are, of course, exceptions—

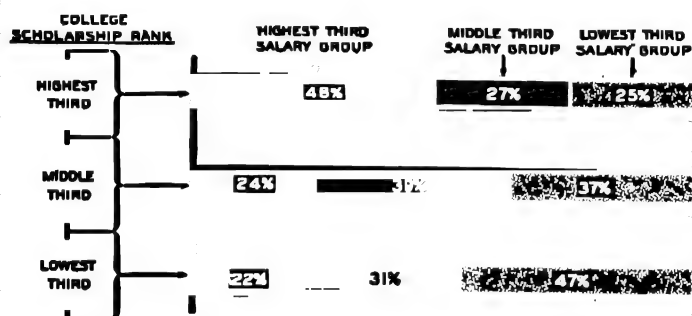



CHART II

Scholarship Rank and Percentage Attaining Each Salary Group

men who were poor students who are succeeding well and men who were good students succeeding less well—but on the whole the evidence is very striking that there is a direct relation between big marks in college and salaries afterward in the Bell System.

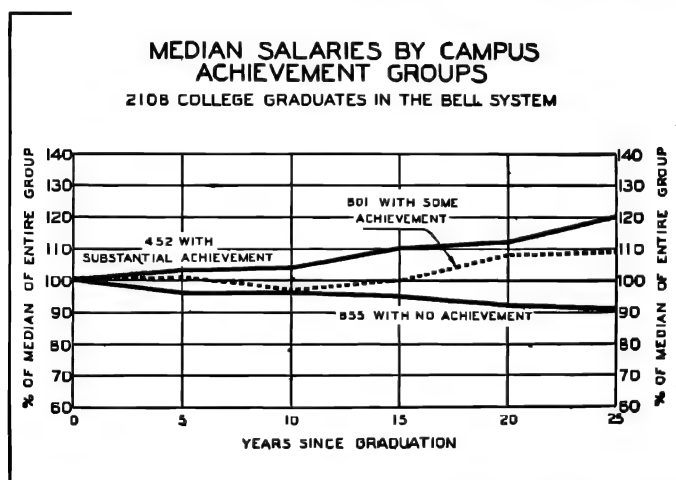
In general the normal expectation is that any college graduate entering business has one chance in three of standing in salary among the highest third of all the college graduates in his company. From this study, as illustrated by Chart II, it appears that the man in the first third in scholarship at college, five years or more after graduation, has not merely one chance in three, but about one in two of standing in the first third in salary. On the other hand, the man in the lowest third in scholarship has, instead of one chance in three, only about one in five of standing in the highest third in

salary. There is also nearly one chance in two that he will stand in the lowest third in salary. . . .

Strikingly enough, almost exactly the same results as those just given were obtained separately for the engineering graduates and the graduates in arts and business who together make up the whole group studied.

3. *Undergraduate Activities and Business Success*

D. S. Bridgman, *Success in College and Business*, 4-5 (American Telephone & Telegraph Co., 1930)

The chart shows the median salaries by campus achievement groups. The men studied were classified into three groups, those

Achievement in Campus Activities and Salaries after Graduation

with substantial campus achievement, those with some achievement and those with no achievement. Some achievement in these classifications means the member of the editorial board of a magazine, the manager of a minor team or magazine, a minor class officer or the member of a social fraternity, the member of a minor athletic team or of a major varsity squad, or finally a member of a dramatic or musical club.

The substantial achievement group means the editor-in-chief of a magazine, the winner of an important oratorical contest or a most important debating-team, the manager of a major team or important student newspaper, a major class officer or member of

an honorary senior society, or the leader of a dramatic or musical club. It also means some achievement in two or more fields but not including fraternity membership only. That is, a man who is on the board of a paper and on a minor team would be regarded as having won substantial campus achievement, but a man who was on the board of a magazine and was merely a fraternity member in addition would not be so regarded.

On the basis of this classification we find that 21 per cent of the 2,108 men covered by this study were classified as having won campus achievement, 38 per cent as having won some campus achievement and 41 per cent as having no campus achievement. The medians in this chart have been carried to only 25 years after graduation as there were not enough cases after that to warrant drawing them any further. We find that the men within the substantial achievement group reach 20 per cent above that for the whole group at the 25 year point. This is just about what the median for the first third men in scholarship did.

It must be remembered in comparing them, however, that this median comprises only 21 per cent of the group studied whereas the scholarship median for the first third comprises about 40 per cent of the group studied. Furthermore, the median for the first tenth comprising 14 per cent of the men studied at 25 years after graduation is 40 per cent above that for the whole group. On the basis of this evidence alone it seems that scholarship is a rather more significant factor than substantial campus achievement.

4. *Leadership with Interest in the Individual*

W. V. Bingham, "Industrial Psychology in the United States: An Appraisal," *Annals of Business Economics and Science of Labour,* 3:403-404 (1930)

Recourse to scientific method in dealing with complicated matters sometimes leads to rewarding surprises. Let me illustrate first from an investigation of physical conditions affecting output which turned out to be a problem of work interests.

This was an investigation of the effects of increased illumination on output. It was planned not by industrial psychologists but by illuminating engineers. This may explain why, during the first year of the study, little attempt was made to control the different extraneous influences which affect output. Instead, records of these variables were kept so far as possible, with the thought that proper allowances could later be made. The results were disappointing. The engineers then proceeded through the coöperation

of certain large factories to experiment, this time holding conditions in certain departments as nearly constant as possible, while from time to time the workers were given the benefit of better and better lighting. In one factory where good measures of quantity and quality of output were available, it was noted with satisfaction that as illumination was increased output increased. Then as a check of the experiment, the lighting was reduced, this time to a point below the original moderate degree of illumination, and—output again increased! These results, I believe, have not been published. But the manager of the factory, who told me about them, learned two lessons. The first is the obvious one, namely the value in experiments of this sort of using the method of the control group. The second lesson is of major importance for industry everywhere, and for the science of industrial psychology. It is, that workers respond with wholehearted effort when management shows a genuine personal interest in what they individually are doing. This is a variable every experimenter must watch and control most carefully. It is a powerful force in industry, for management to utilize to its benefit or neglect at its peril.

My second illustration is an experiment which has been in progress for the past two years in a manufacturing plant, to determine the factors which influence variations of output. Nearly every alteration made, such as introduction of rest periods, change in basis of payment, etc., was followed by a rise in output. Here again, the factor which nearly swamped all the others was apparently the response of these girls to the keen interest which the executives and supervisors showed in them and the work they were doing. In any event, the management, as a consequence, is now taking steps to train the supervisors throughout this vast plant in a way to give them all a fresh personal interest in the individual workers they are overseeing. Evidently industrial psychology and industrial management in America are together rediscovering the individual and recognizing the importance of the whole man in his personal relations as well as in his relations to his machine and to his physical environment.

B. Inadequacies of Management

5. *Adjusting the Technical Balance*

SAM LEWISOHN, "Relation of Engineering Education to Industry," *Engineering Education*, 33:152-3 (1926)

The evidence is overwhelming that the usual practice in the past of confining the training of the engineer solely to studying the reactions of dead matter has tended to cripple him in his handling of human relations. A purely technical education in problems which require quantitative methods does not equip a man to assume leadership of men. As a matter of fact, if properly trained, the engineer manager is a big improvement upon the layman manager. An engineer does learn to be dispassionate and objective about matter having to do with technical problems. There is no reason why this thoroughness and openmindedness with reference to mechanical matters should not be translated to his activities in the field of human relations.

6. *Social Adjustability*

B. V. MOORE and G. W. HARTMANN

The engineer lives not only in a world of machines but in a world of men. His social relations are not less significant than his technical problems. Yet it is unfortunately too often true that the technician's personal and educational limitations are conspicuously prominent in the field of human relations. A clever designer may frequently cause difficulties for himself and others by unwise, if not stupid, managerial tactics; a competent craftsman lowers his efficiency and value through lack of consideration for his associates; and an important executive courts misunderstanding by proneness to rationalization. The removal of these obstacles to coöperative endeavor requires measures which vary in degree from simple suggestions concerning courtesy to a basic reshaping of the total personality in accordance with the principles of mental hygiene.

Numerous thinkers have suggested that just as the nineteenth century witnessed an extraordinary increase in man's control over the forces of inanimate nature, so the twentieth century may see a new mastery of personal and social resources. The engineer is peculiarly fitted by his position to facilitate a more thorough coördination of human energies and natural forces to this end. That such a prospect reveals serious dangers as well as worthy

possibilities makes it all the more necessary to insist on adequate preparation for these added responsibilities.

In the light of such requirements, it is easy to uncover obvious shortcomings in the traditional engineering curriculum. Leaders in the profession have sought to provide against charges of narrowness or uncouthness by educational revisions including literature and the various social sciences. To meet even in part the future wants of both the technical expert and the cultural executive involves difficult if not insuperable modifications in selection and training. No solution which involves any additions or omissions from the already overburdened undergraduate curriculum seems feasible. It may be possible to postpone the "humanistic" features of engineering work to the graduate school, and thus pave the way for a hierarchy within the profession based upon four, five, six, or even seven years of university study; or the same goal might better be achieved by inverting the order of the technical and cultural divisions. Another plan would be some sort of in-service training akin to that already designed for teachers. This last method would have the advantages of reaching larger groups with less experience, but with a probable loss in thoroughness of instruction. This whole problem is closely related to the still larger problem of adult education which has recently come to the foreground in problems of leadership.

It should be emphasized that the real objectives of such a program cannot be insured by the offering of formal courses, no matter how ably taught or diligently pursued. *Management engineering, to be effective, must begin with the engineer himself.* He does not need to be a paragon of virtue; but he must in some way acquire those personal traits which make or mar his effectiveness. A system of individual guidance, begun in the pre-college years if possible, promises the maximum returns. Social participation often deserves encouragement, provided its benefits extend beyond surface demeanor. Whatever scheme is adopted, the important feature should involve developing the whole man as well as the engineer. Only thus can the profession insure itself against the indictment of provincialism and overspecialization, all of which spring from an original limitation of outlook.

7. *Rationalization of Autocratic Tendencies*

J. D. Houser, *What the Employer Thinks*, 117-122 (Harvard University Press, 1927)

Striking illustrations of rationalization were apparent in the attitudes of certain employers whose autocratic tendencies, even if

not obvious to themselves, were easy to detect. In two instances, executives attempted to justify acts inspiring fear in the workers, on the ground that fear is a useful motive in industrial relations. Then they hastened to expatiate at length upon the great importance of their "welfare work." It was natural to suspect a conflict of attitudes or to infer that the assumed benevolence was a mere cloak. When this type of executive repeatedly emphasizes the profitableness of welfare work, stating to business associates and other executives that "it pays in dollars and cents," although there is no accounting system for proving this, the effort to gain approval from another audience is glaringly apparent. The underlying motives seem clear—a desire for power and a haunting fear of being compelled to relinquish it. This sheer autocracy is coupled, in the first place, with the strong desire to gain social approval by exhibiting benevolence, and, in the second, to avoid the disapproval of hard-headed business associates by justifying the large expenditures involved in welfare work. In each case fear is evident—fear of losing power, fear of having fear known, and fear of losing caste with business associates because of impractical schemes. . . .

"Face-Saving."—The avoidance of social discredit, sometimes called "saving one's face," is a type of negative rationalization as illuminating as is the positive attempt to gain credit. One executive gave naïve, not to say far-fetched, reasons why no sons of his workers ever applied for jobs in his plant. Management practices and working conditions there were anything but attractive. The reasons, however, why no member of the second generation cared to apply for employment were, he was positive, the common desire of mothers for "white collar" jobs for their sons, and also the practice in the American Public School of firing the ambition of every boy to become president of the United States. . . .

Degrees of Rationalization.—. . . The extremes of rationalization are well presented in two illustrations based on several interviews. One concerned the owner and executive of a moderate-sized manufacturing organization. Aided by very favorable general conditions, he was making his enterprise a profitable one, although his wage scales were as low as he could keep them and yet maintain a supply of labor. He was active in a religious body. At a meeting largely attended by members of his church, he heard a certain plan of "industrial democracy" discussed. Feeling the intense appeal of the plan to the idealism of these people, he sought further details regarding its operation. He even authorized preliminary steps toward introducing it into his own industry. When he learned, however, that he would be obliged to reveal some-

thing of the financial details of his enterprise, he quickly withdrew this authorization, refusing to consider any further application of the plan.

Another illustration of obvious rationalization was found in an executive's explanation for his feeling that any form of profit-sharing was dangerous. Under such a plan, he thought, employees could legally examine the books of the company at any time. They might find, for example, that eight per cent was deducted each year for depreciation of machinery and equipment. Being ignorant of such matters, they might think this too large a percentage (since it reduced their share in the profits), and might insist that the figure be cut to two per cent. The man of straw which this executive carefully constructed out of his objection to profit-sharing was hardly convincing. . . .

An equally clear case of rationalization is found in the reason which an executive gave for employing "under-cover" men. These operatives, he insisted, were used largely for the constructive purpose of reporting to him any evidences they found of foremen mistreating workers. Apparently these men actually were so used, but it was evident that this was not their only or their chief function. For little thought had been given to any other means than this for ascertaining the type of morale in the plant. And personnel practices there were elementary, to say the least.

8. *Education versus Propaganda*

H. C. LINK, *Education and Industry*, 75-77 (The Macmillan Co., 1923)

A tell-tale characteristic of propaganda is its source. It is obvious to the most casual observer that most propaganda originates from an interested rather than a disinterested source. When the ordinary worker reads about the wonderful merits of his country and the tremendous advantages of its economic system, he is very much inclined to think: "It is very well for you to talk in such glowing terms because you have succeeded, you have been lucky, and now you are trying to prevent the big majority of us from taking steps that will give us our just dues." In other words, when the employer eulogizes the present economic system, his employees suspect him of being more interested in maintaining his own comfortable status than in helping them to achieve an equal status. It should not for a moment be thought that we are here questioning the sincerity of those who are responsible for this propaganda. We are simply pointing out the manner in which propaganda of this nature is likely to be received by those for whom it is intended. . . .

Another characteristic of propaganda is its indiscriminate optimism. There is an enormous quantity of propaganda which presents the virtues of America and its economic system in such beautiful colors that it defeats its own aim. A sure way in which to call attention to the defects of anything, whether it be a country or an automobile, is to dwell too long and too enthusiastically upon its virtues. When the ordinary employee reads literature of this kind his thoughts are inevitably driven to the many exceptions, the many injustices and inefficiencies which exist even in the most perfect system. Instead of taking the large view, he immediately thinks about his own unhappy experiences. It is axiomatic that the human mind generalizes from its personal experience rather than from the experiences of others. The attempt to make a person believe that everything is as it should be in spite of the fact that his experiences have been to the contrary works directly against this fundamental law of human psychology. Discriminating propaganda, if there be such a thing, would include the admission that conditions are not ideal and would go on with a constructive exposition of the part which all groups in the community could play in making them better.

Closely allied with the indiscriminate optimism of most propaganda is its essentially negative character. There is a marked tendency to tell workers what they cannot or may not do. They must not disregard the rights of property. They must not scorn capital. They must not join the I. W. W. or other radical organizations. They must not play with socialism or communism. They must not regard unionism as a solution of their labor difficulties. They must not despise the constitution or the two-party system of government. Our exposition of this characteristic of prevalent propaganda may be somewhat exaggerated but it is an undeniable fact that present-day propaganda is concerned entirely too much with pointing out the dangers which confront the worker and entirely too little with the opportunities he has and the manner in which he may use them to his advantage. Such a course is exactly like that of a mother who is constantly telling her children not to do this and not to do that. The only sound way in which to engender a respect for property is to show people how to acquire it and how to avoid losing what they have. The surest way in which to inspire loyalty to a government or to an economic system is to show people how they may use it to their personal advantage. In other words, by a process of genuine education in the fact which will contribute to their intelligent and profitable coöperation with the system under which they live.

9. *A Tactless Taylorism*

F. W. Taylor, *Principles of Scientific Management*, 59 (reproduced by permission of Harper & Bros., 1919)

Now one of the very first requirements for a man who is fit to handle pig iron as a regular occupation is that he shall be so stupid and so phlegmatic that he more nearly resembles in his mental make-up the ox than any other type. The man who is mentally alert and intelligent is for this very reason entirely unsuited to what would, for him, be the grinding monotony of work of this character. Therefore the workman who is best suited to handling pig iron is unable to understand the real science of doing this class of work. He is so stupid that the word "percentage" has no meaning to him, and he must consequently be trained by a man more intelligent than himself into the habit of working in accordance with the laws of this science before he can be successful.

10. *Time Study and Task Setting: Their Purposes, Methods and Results*

R. F. Hoxie, *Scientific Management and Labor*, 54-57 (Appleton, 1916)

The time study man is, from the viewpoint of labor, the central figure in scientific management—its vital organ and force. To perform his functions properly, to make scientific management tolerable to labor, he must be a man exceptional in technical and industrial training, a man with a broad and sympathetic understanding of the workers as well as of the economic and social forces which condition their welfare, a man of unimpeachable judgment, governed by scientific rather than pecuniary considerations, and, withal, he must occupy a high and authoritative position in the management. For if he is to set tasks that will not cause nervous and physical exhaustion, he must not only have an intimate personal knowledge of the work to be done, the special difficulties it involves, the qualities required to do it well, the demand which it makes on strength, skill, ingenuity and nervous force, but he must also be able to recognize and measure nervous disturbance and fatigue and understand and deal wisely with temperament. If he is to set tasks which will always be fair and liberal, he must understand and know how to discount all the effects of current variations in machinery, tools and materials, in human energy and attention. If he is to safeguard the lives and health of the workers and their general economic and social welfare, he must be an expert in matters of sanitation and safety, and have a broad and

deep understanding of economic and social problems and forces, and, finally, if he is to make all this knowledge count, he must be able to establish the standards warranted by his study and judicial weighing of men and facts and to protect these standards against infringement and displacement. All this and more, if the claims of scientific management relative to labor are to be generally fulfilled.

But as things actually are, this emphatically is not the type of man who is habitually engaged in time study work, and who is being drawn into it, nor does the time study man of the present occupy this exalted position in the hierarchy of scientific management. The best men in this work are perhaps technically qualified, but, so far as the observation of the writer has gone, the best of them are technicians with little knowledge of the subject of fatigue, little understanding of psychology and temperament, little understanding of the viewpoint and problems of the workers, and almost altogether lacking in knowledge of and interest in the broader economic and social aspects of working-class welfare. The bulk of the time study men encountered were immature men drawn from the shop or from college. They were expected to get their knowledge and training in all the matters enumerated above through the actual work of time study and task setting. In the majority of cases encountered, it was not considered essential that they should have had any special training in the particular industry. A man who had worked exclusively in the machine shop was considered competent after a few weeks or months of contact and trial experience to set tasks in a cotton mill. Sometimes, previous industrial experience of any kind was not considered necessary. Analytical ability, good powers of observation, a sense of justice and tact were the chief qualities emphasized as essential for a good time study man. Rarely, if ever, was anything said of technical knowledge concerning fatigue, psychology, sanitation, safety, and the broader problems of industrial and social welfare. Indeed, time study and task setting were almost universally looked upon as primarily mechanical tasks in which the ability to analyze jobs and manipulate figures rather than broad knowledge and sound judgment were regarded as the essential factors. Naturally, therefore, the time study men were found to be prevailingly of the narrow-minded mechanical type, poorly paid and occupying the lowest positions in the managerial organizations, if they could be said to belong at all to the managerial group. Nor does the situation seem to promise much improvement. For the position and pay accorded to time study men generally are such as to preclude the drawing into this work of really competent men in the broader sense. Aside from a few notable exceptions in the shops, and some

men who make a general profession of time study in connection with the installation of scientific management, this theoretically important functionary receives little more than good mechanics' wages, and has little voice in determining shop politics.

11. *The Key Position of Foreman*

B. V. MOORE and G. W. HARTMANN

The peace and welfare of the ordinary industrial worker is assured or violated by the kind of foreman under whom he serves. It is the foreman who represents the immediate and effective authority of the plant management. The efficiency of the workmen is unquestionably influenced more by the varying personalities of their closest superiors than by the policies and attitudes of remote executives, just as the reactions of the private are conditioned more by the nature of his top-sergeant than by the decisions of the high command.

The foreman occupies an important post from the standpoint of the industrial psychologist, because, in addition to his primary function as "production-chaser," he normally acts as a teacher and trainer of new men and as an arbiter of the destinies of his experienced hands. His competence in the last two tasks is probably a more crucial factor in determining his worth than his recognized skill as a master workman; and yet it is in these fields that he has generally failed most miserably.

Consider, for example, the typical process of "breaking-in." An office boy or junior clerk escorts the newly hired man to his future boss. The foreman is probably busily engaged at some minor task and acts annoyed at the intrusion. Without smiling, he pauses in his work to ask the newcomer, "What's yer name?" without volunteering his own. He doesn't mean to be gruff, but the new man who is anxiously watching every move is saying internally, "I don't think I'll like that feller." If the man is green, he must be taught, for example, to operate a lathe. His instructor naturally wants him to master his job as rapidly as possible, so he eliminates all the items he considers non-essential, such as guarding against rare accidents and detailed replies to the learner's questions which mean so much to the beginner.

Still the foreman is not the only sorrow in the workman's life. The newcomer is constantly plagued by the hazing of others, especially if he be younger, a foreigner, or less experienced. His tools are stolen or hidden from him, and he is regularly sent on goose-chases, such as going to the engine room for a pail of steam, requisitioning a rubber hammer from the stock room, borrowing a

wire-stretcher from another department, etc. Usually the worker survives and makes a passable showing—but we forget the many cases when he does not. The irritation, too, may linger on and crop out in many unforeseen and undesirable ways.

In matters not directly pertaining to his job, the newcomer's adjustment is slow and difficult. The locations of important sites and persons, the procedures to be followed in having pay corrected, the numerous major and minor rules of the company—all these things must be picked up incidentally and incompletely, rather than imparted in a friendly and accurate way.

While recognizing the limitations of the average foreman, his difficulties should also be appreciated. He is caught between two fires. Having risen from the ranks, his socio-economic status is no better than his maturer subordinates, but he must act as representative of a management to whom he knows he is intellectually inferior. He has obviously tended to look upon most selection and training devices as attempts to deprive him of his authority. The foreman's ambiguous position could be greatly alleviated by a genuine admission to participation in management, a more dignified status, greater possibilities of promotion to executive work, and, of course, better choice and training of candidates.

C. Constructive Industrial Guidance

12. *Social Understanding and Technical Knowledge*

J. M. Brewer, "Causes for Discharge," *Personnel Journal*, 6:171-172 (1928); reprinted by permission of Williams & Wilkins Co.

The Bureau of Vocational Guidance of Harvard University some time ago put together some statistical data published in various sources, giving the actually recorded reasons for discharges from industrial establishments in 4,375 cases. The figures were classified by us under two main headings: Lack of Skill or Technical Knowledge, and Lack of Social Understanding, and are shown in Table I.

In our tabulation we have considered "skill" to be the actual *doing* of the work. "Technical knowledge" is the *science* back of the work—the *how*—represented usually in industrial establishments by computations, use of blueprints, and applications of laws of physics and chemistry. By "social understanding" we mean human relationships or job wisdom: those qualities of character which ordinarily go deeper than skill or technical knowledge.

Our table shows clearly that while incompetence is the largest single cause, yet all causes that could possibly be classified as skill

and technical knowledge together total slightly over one-third, while the social understanding causes constitute the controlling reasons in about five-eighths of the cases.

It seems to be a very common failing on the part of workers in vocational education to attribute too much general spread or transfer to these qualities listed under social understanding. A person is supposed to have qualities of character which he can apply to almost any situation. But it may very well turn out that the

TABLE I

REASONS FOR DISCHARGE FROM INDUSTRIAL ESTABLISHMENTS

Reasons	Number of Cases		Per Cent	
Lack of Skill or Technical Knowledge:				
Incompetence	1,110		25.3	
Slow	200		4.6	
Physically unadapted	170		3.9	
Spoiling work	16	1,496	0.4	34.2
Lack of Social Understanding:				
Insubordination	486		11.1	
General unreliability	453		10.4	
Absenteeism	442		10.1	
Laziness	317		7.2	
Trouble making	179		4.1	
Drinking	179		4.1	
Violation of Rules	142		3.2	
Carelessness	120		2.7	
Fighting	104		2.4	
Misconduct	100		2.3	
Dishonesty	91		2.1	
Loafing or sleeping	77		1.8	
Dissatisfied	23		0.5	
Habitual lateness	17	2,730	0.4	62.4
Unclassified		149		3.4

carefulness or the patience of a street car motorman is quite different from the carefulness or patience of a street car conductor. The question is at least worth raising, whether "job wisdom" should not be taught in a situation closely resembling the actual job. Psychological principles seem to favor the notion of close association of ideas and to disfavor the notion of depending upon transfer.

The importance of these facts for vocational education are patent. What shall we say of an industrial school which gives 50 per cent of the students' time to developing skills, 30 per cent to classes in

mathematics, drawing, and science, and 20 per cent to general studies such as English, civics, hygiene, etc.? If these schools are neglecting an opportunity, what shall we say of an analogous plan in a professional school, such as law or dentistry, where the human factor is no doubt even more important?

The facts have importance for vocational guidance also. They indicate that exploratory courses should place children in situations where these qualities of character will be called into activity, and that classes in occupations should then carry on a correlative discussion of problems relating to job wisdom.

For personnel men these facts indicate the importance of shop morale and of the development of character qualities through employee activities and employee leadership.

13. *New Corrective Methods*

L. M. GILBRETH, *The Psychology of Management*, 69-71 (The Macmillan Co., 1921)

Under traditional Management, the disciplining is done by the foreman; that is, the punishment is meted out by the man who has charge of all activities of the men under him. This is actually, in practice and in theory, psychologically wrong. If there is one man who should be in a state of mind that would enable him to judge dispassionately, it is the disciplinarian. The man to be disciplined is usually guilty of one of six offenses:

1. an offense against an employee of a grade above him
2. an offense against an employee of the same grade
3. an offense against an employee of a grade below him
4. falling short in the quality of his work
5. falling short in the quantity of his work
6. an offense against the system (disobeying orders), falling down on schedule, or intentionally not coöperating

The employee over him, or the foreman, to whom he is supposed to have done some injustice, would be in no state of mind to judge as to the man's culpability. In the case of an offense against an employee of the same grade, the best that the injured employee could do would be to appeal to his foreman, who oftentimes is not an unprejudiced judge, and the multiplicity of whose duties gives him little time to give attention to the subject of disciplining.

If the offense is against quantity or quality of work, again the old-fashioned foreman, for lack of time, and for lack of training and proper standards of measurement, will find it almost impossible to know how guilty the man is, and what form of

punishment and what amount of punishment or loss of opportunity for progress will be appreciated.

All this is changed under Scientific Management. The disciplinarian is a specially appointed functional foreman, and has few other duties except those that are directly or indirectly connected with disciplining. He is in touch with the requirements of the work, because he is in the Planning Department; he is in touch with the employment bureau, and knows which men should be employed; he has a determining voice in deciding elementary rate fixing and should always be consulted before wages are changed or a reassignment of duties is determined. All of these are great advantages to him in deciding justly and appropriately punishments and promotion, not for the workers alone but also for the foremen and the managers.

The Disciplinarian keeps a record of each man's virtues and defects; he is in position to know all about the man; where he comes from; what his natural and acquired qualifications are; what his good points, possibilities and special fitness are; what his wages are, and his need for them. All that it is possible for the managers to know of the men is to be concentrated on this disciplinarian. He is, in practice, more the counsel and advocate of the worker than an unsympathetic judge, as is indicated by the fact that his chief function is that of "diplomat" and "peacemaker." His greatest duty is to see that the "square deal" is meted out without fear or favor to employer or to employee.

14. *The Problem Employee*

V. V. ANDERSON, "The Problem Employee," *Personnel Journal*, 7:205, 207, 210-213 (1928); reprinted by permission of Williams & Wilkins Co.

Experience has taught us that the best sort of scientific staff for dealing with the varied problems found among workers consists of a psychiatrist, a psychologist and a psychiatrically trained social worker,—the same sort of working team that has proved most successful in other fields where the problem has been human behavior. The contributions of those three groups,—the medical, the social and the psychological,—when combined in a well organized unit, form the ideal grouping and the minimum basis for an adequate program of diagnosis and treatment of work maladjustments among employees.

The methods employed in conducting a complete psychiatric study can, for practical purposes, be roughly classified into (*a*) the social history, (*b*) the job behavior study, (*c*) the physical examination, and (*d*) the mental examination. These four together

make up a thoroughgoing picture of the whole individual,—his behavior to his work and to major life situations, as well as those influences,—constitutional, or home, or school, or work,—that have contributed most to his career.

(a) *The social history* includes a (1) *health history* (both physical and mental); (2) the *family history,* with particular reference to present family situations and home problems of an economic, health or psychological nature—discontent, friction, unwholesome atmosphere, impaired family relationship, etc.; (3) an *educational history,* including academic training, specialized vocational equipment or considerable job experience—which in itself provides expertness at work; and finally, (4) the *work history,*—leading the individual to give an account of the nature of his first regular job, his attitude toward the work, the salary he received, the length of time employed at it, his reasons for leaving, the period of idleness before his next job, what its nature was, his mental attitude toward the work, his salary, the length of time he remained employed at it, etc.,—bringing him up to the present time. This may give us a splendid picture of his work adjustments, and always throw light upon his personality make-up. . . .

Problem cases may be divided into at least two groups. Group A includes those problem employees whose main difficulties lie in their own make-up and the disorder of their own *personality,* rather than in the fact that they are in the wrong job. A careful psychiatric inquiry discloses the nature of these difficulties and the important causative factors underlying the problems presented. Treatment work on these cases involves adjustment of the employee *right within his department.* This is accomplished through frequent contacts with the psychiatric social worker or the psychiatrist, and a well-planned therapeutic régime is followed out over a sufficiently long period to bring about changes in the behavior of the employee.

Case No. 3, Female, Age 48, Sales Clerk

Problem.—Acting peculiarly on the floor, and complaining bitterly to her Buyer of the persecutions of her associates, she was referred to the Conference Office for psychiatric study.

Study.—In the Conference Office this woman showed an acute anxiety state; was in great distress with marked depression. She says, "I have not been able to sleep or eat for five whole days." (Cries and wrings her hands.) "I saw a tall detective lean over and whisper to a girl at the ——— counter, and he said, 'You watch that woman, she is a thief, and is stealing from the store.' Then there are two elderly women who have put the girls up to watching me, and the girls pass up and down the aisle saying, 'Keep your hands off the ———, etc.'

They whisper to each other about me and wink in a knowing way as if to imply they are on to me. They are all talking about me."

A careful investigation was made, and it was disclosed that the employee had seemed ill for several days, but that for weeks she had been very "nervous," stayed by herself, was over-sensitive and "imagined" things. There was no basis for suspecting her honesty; nothing was missing from her department and she was considered one of the most valuable sales clerks in the store, and regarded by all as thoroughly reliable.

Her aged mother had been seriously ill for several months, and at this time was near death. This employee was up with her a great deal at night and as a result had lost much sleep. She also had to do the housework and the cooking, which, with the arduous duties of the day as a sales clerk, had brought on acute fatigue. Such a condition, in a distinctly psychopathic personality, who for years had exhibited an unstable nervous system, on to which was engrafted an anxiety as to the possible death of her mother, and the possible loss of her job inasmuch as she was falling down in her work, finally resulted in a full-blown mental disturbance.

In our examination we found her suffering from well-marked delusions of persecution, retardation of thought processes, with a depressed emotional state and slowing up of bodily movements.

She was placed at once under psychiatric care, reassured regarding her job and her department worries. A social service worker and nurse were sent to her home, and for a few days she was kept in bed and carefully nursed. In time she began to recover, returned to the store, was placed back in her old department under the best possible controlled conditions, in the hands of a Buyer who was not only sympathetic but intelligently understanding. In the end she recovered and is still with the store as a valuable employee.

Follow-Up.—Ten months later her buyer reports, "She is doing very well, and no longer seems worried or fearful." One year and a half later, her Buyer reports, "She is good and in her present capacity, I couldn't do without her. There is no problem or complaint." Her section manager says, "Miss ——— is satisfactory, and a very efficient sales clerk." . . .

We come now to a new group of problems in which the *job maladjustment,* rather than the personality disorder of the employee, stands out as the most important factor in the situation. To be sure, we will have other issues to face, but the transfer to more suitable work, with proper training and adjustment on the job is what is needed.

Case No. 4, Age 19, Female, Cashier

Problem.—Referred by Superintendent of Department, on account of the great number of errors and shorts which she made, with the statement that if she did not improve soon, she would be laid off.

Physical Findings.—Height 5 feet 8 inches. Weight 110 pounds. Considerably under-nourished. Has had several attacks of tonsillitis, and recently has had a growth on plantar surface of right foot which has been removed. In re-examination, August 23, 1926, she was rated "B" by Hospital, due to underweight.

Mental Findings.—She has an intelligence quotient of 88, rating her as dull average in intelligence. She was found to be slow in speed tests; fair in learning ability; poor in motor dexterity; and showed a tendency to errors in accuracy tests. She has a pleasant and agreeable personality make-up, though a little peculiar and not very accessible to a personal interview owing to rather marked conflicts. She does not concentrate well on the things at hand, showing a definite tendency to mental reverie. She has a good general appearance, is rather attractive, neat and well-dressed. There is considerable emotional upset with some depression. She is rated poor on our cashiering tests, and because of her mental condition we do not believe she should be kept at this work as she will make shorts. She has a good personality for sales, and if her mental conflicts can be successfully dealt with, she ought to make a good sales clerk.

Social Findings.—Mother dead; father married second time. Home situation unhappy. Had to leave home and is boarding with private family. Said that she was forced out of her own home. Has to support herself. Has had two years of high school.

Conclusions.—This girl will never make a successful cashier. She is too slow in motor speed, and is not accurate by nature. She should succeed fairly well at sales. Transfer to sales is recommended.

Follow-Up.—Girl was transferred to house furnishings as sales clerk where she did well, being rated as satisfactory by the head of the department, who expressed himself several months later as pleased with the new clerk. Inasmuch as she did not like it in the basement, she was transferred, after a period, to a department on the first floor where she did fairly well. She has been under the supervision of the psychiatrist, and has improved considerably in her personality disorder. Her health is excellent, and her sales are fairly good. The average selling cost of her department is 4.35 per cent, while this employee's selling cost is 4.29 per cent. Her interest in stock has been marked. She has proved reliable and gradually has taken on responsibility. Her contact with other girls has been good, and she is now being tried out for head of stock,—a promotion for which there is considerable competition. She has developed an alertness, aggressiveness and self-confidence, that has made her effective as a sales clerk.

15. *A Critique of Modern Industry*

D. L. HOOPINGARNER, *Labor Relations in Industry*, 9-11 (McGraw-Hill, 1926)

If certain standards be set up according to which the industrial order as it has affected human relations may be judged, the present

industrial system can be briefly and unfavorably characterized on a number of major counts.

1. The purpose of business as conducted in the past has largely been to produce for the sake of profits. The emphasis has been on the materials and methods of production as a means toward securing wealth. The factory system, which has been predominant during the last 150 years, has thus far reflected a materialistic philosophy of life. Human values have become secondary or lost sight of in the rush for things.

2. Industry has been working, by and large, for *amount* of production with too little attention to the *nature* of the things produced and to their most effective marketing. Industry has produced what it could sell or what it hoped to sell, rather than what ought to be produced, and then has developed highly commercialized machinery to distribute these goods. The relative values of wealth itself as well as of the application of effort and the coördination in industry have become lost in the shuffle.

3. Industry in general has been conducted on a *conflict* basis. Little or no mutuality of interest between capital and labor has been recognized. The two great parties to industry, individually and in group, have not recognized each other as coworkers of common interest in any real sense.

4. Within minimum limitations, the type of control and ownership in industry has been absolute and too frequently autocratic. The employer has had the right of arbitrary decision and absolute proprietorship. Whether or not he has been moved by proper motives and has exercised his privileges and shared his rewards in the past to the best advantage of all the units in society is another, though important, question.

5. Labor as the furnisher of productive power has largely been considered a *commodity* without recognition of primary rights of personal well-being. Man's value as a worker has been too largely determined by the mechanistic operation of supply and demand. At times manipulation has increased the undesirable effects of the operation of supply and demand *per se*.

6. The social status of the worker has been in many ways an inferior one. He has been personally free, but economically dependent, and therefore, to a substantial degree in social dependence upon his employer.

7. Throughout the whole course of development of the present industrial order there has been an ever-increasing degree of organization among the workers themselves, on the one hand, into strong labor unions, and among employers, on the other hand, into

powerful employers' associations. Sometimes these have been designed, established, and conducted for the purpose of active industrial warfare.

16. *Self-Rating Scale for Leadership Qualities*

W. W. CHARTERS and D. R. CRAIG, *Personal Leadership in Industry*, 235-236 (McGraw-Hill, 1925)

1. Forcefulness:
   a. Do I give my orders properly and see that they are followed out, maintaining a business-like attitude constantly?
   b. Do I keep in touch with the efforts of my men so that I know how well each is working?
   c. Do I preserve the right balance between too much sternness and too much familiarity?
2. Ability to inspire confidence:
   a. Do I show respect for my men and myself?
   b. Am I impartial, or do I play favorites?
   c. Do I exercise self-control, or do I allow my temper frequently to get the better of me?
3. Ability to take a personal interest in the men:
   a. Do I talk with the men as men rather than as inferiors?
   b. Do I give them personal training and discuss their work with them?
   c. Do I get things for them which they would be unable to get without my assistance?
   d. Do I help them to realize their ambitions?
4. Ability to get the work done correctly:
   a. Do I give instructions so clearly that no one can misunderstand what is wanted?
   b. Do I check up on my men to see that my orders are followed out exactly?
5. Ability to get and use the ideas of the men:
   a. Am I successful in getting suggestions from the men?
   b. Do I use these suggestions when I get them?
   c. Do I give credit to the man who gives me an idea, when I am talking about it to my superiors and colleagues?
6. Ability to be one of the men:
   a. Do I work with them rather than over them?
7. Ability to lead rather than boss the men:
   a. Do I show the men how they can work more efficiently, rather than ordering them about without showing them how?
   b. Do I train them in better methods?

c. Do I set the example by being as hard on myself as I am on any of my subordinates?

8. Ability to develop teamwork:
   a. Am I careful to plan ahead?
   b. Is the mechanical equipment for which I am responsible always ready for work?
   c. Do I place the right men in the right positions?
   d. Do I allocate the responsibility for results so that my men know what they have to do?
   e. Does the spirit of teamwork exist among my men?
9. Ability to show kindliness without being considered easy:
   a. Do I remember that my men are human beings and treat them with common courtesy?
   b. Do I work for the interest of my men?
   c. Do I know how to keep the men from imposing on my good nature?
   d. Can I properly balance praise and censure?
10. Ability to reprimand properly:
    a. Do I always make sure of my case before I reprimand?
    b. Do I give reprimands in private, except in unusual cases?
    c. Do I reprimand in a straightforward manner, or do I merely nag?
    d. Do I give the reasons for my reprimands?
    e. Do I follow up the reprimand?
    f. Can I reprimand a good man and make him feel that it is fair?
11. Ability to keep from worrying:
    a. Do I worry too much about myself, my home, or my job?
12. Ability to delegate work properly:
    a. Do I thrust responsibility on my men, allowing them to make some mistakes?
    b. Do I train them on the job so that they can take over work that I ought to give them?
    c. Am I willing to delegate work, or do I feel that I want to do everything myself?
13. Ability to call forth the best efforts of the men:
    a. Can I develop enthusiasm in my men?
    b. Do I know how to prevent idling and carelessness?
14. Ability to train men on the job:
    a. Do I know how to analyze a job before teaching it to a beginner?
    b. Do I show him carefully how to do it?
    c. Do I let him try it while I watch?
    d. Do I correct his mistakes?

e. Am I in the habit of keeping my eye on a beginner until he is able to do the job well?
15. Ability to make a new man feel at home:
   a. Do I introduce the new man to the older men around him?
   b. Do I show a personal interest in him?
   c. Do I make it easy for him to ask questions?
   d. Can I make him enthusiastic about his new job?
16. Self-confidence:
   a. Am I sure of myself on the job, or am I afraid of it?
   b. Do I help my subordinate to overcome self-consciousness?
   c. Do I show him that he is better than he thinks he is?

17. *Integrated Objectives*

ORDWAY TEAD, "Trends in Industrial Psychology," *Annals of the American Academy of Political and Social Science*, 149:238:111, 116-119 (1930)

We have become accustomed to think of corporate or group objectives as single. In economic life the single objective is usually conceived in terms of stockholders' profits. My contention is that this statement is unduly and falsely simplified. Corporate objectives are never single, if analysis is profoundly pressed. They are plural in fact, if not in law. Once you start talking about considerations of "service," quality, low price, good name, good will, community standing, employee loyalty, or any other related and secondary aim, the singleness of all operating aims goes by the board. Modifying factors of considerable force may and do enter in. Objectives have become plural; and only as they are explicit, are acknowledged, are comprehensive enough to allow the entire personnel both to agree to and to embrace them, are the conditions set under which the relations of objectives to employee effort become dynamic and causal in a positive way.

My central thesis would be—and it is psychological in origin and upshot—that *only in the corporate group which has thought through and espoused its plural objectives in such a way as to make some if not all of them assimilable by, and acceptable to, all its members* (which here means employees), *does there exist the underlying psychological setting in which corporate action as such proceeds in the most harmonious and productive way.* The working effectiveness of a corporate group can never approach its potentialities until it has clear objectives to which its members can and do give explicit allegiance.

All the subsidiary efforts of facilitating the relation of the individual employees and newcomers to their work, to their super-

visors, to small internal groups, and so forth, are directly conditioned by this major problem: *Can employees' purposes and corporate objectives be reconciled?* The answer is that they can, only when and if those objectives or aims are conceived in the light of full knowledge of the natural desires, impulses, and satisfactions which the rank and file in normal self-interest and search for self-realization must seek to protect and to express.

. . . The last few years have seen impressive developments, both in the conception of leadership espoused and in the attention paid by companies to shifting the point of view of their managers and foremen from a bossing to a stimulative habit of mind and conduct.

The conception of leadership itself has been beneficially affected by at least two complementary ideas. What has been called "the law of the situation" has been evoked to call attention to the fact in the first place, that to a large extent the function of directing or leading a group is one in which the power and the significance of the director inhere in the position and not in the person. Command and leadership inhere, in part at least, in positions of leadership. And here is no real reason why those in such posts should arrogate to themselves special prerogatives, vanities, or superiorities. The important thing is to define responsibilities and aims at every executive level; and then let the executive be at the same time the spokesman of a function and the animating spirit of its functionaries. The law of the situation implies a release of attention on the part of leaders for the work of teaching and inspiring.

The second qualifying idea is that the leader is at bottom an influencer. His influence depends for permanent results on the motives he appeals to in those led. Psychologically it is incontestable that the good leader is he who gets others to act *because they come to want to act as he proposes.* The emphasis shifts from his "will" to his grasp of their desires and purposes and his insight into *how* what he wants, or comes to want, can be fairly reconciled and integrated with what they want or come to want.

We are brought back to the pervasive and recurrent problem of objectives! The leader who is to be creative, who is to tap unrealized springs of sustained effort in those led, who is to release the human energy which others stand ready to summon, is now coming to be seen as one *who knows how to contrive the whole setting in which he works so that it will support his implicit and explicit affirmation that a truly common end is being served as the enlightened* aims of the leader are being pursued. . . .

Up to the present time, the greatest value of psychological study in industry has been its effect upon the *attitude* of executives. The kind of personnel efforts in which more and more companies

are engaging offers the most convincing and concrete evidence of this.

In the last few years, there has been a genuine shift in industrial perspective. The integrity and the growth of the individual at his work is much nearer the center of attention than ever. If we ask why this is, the answer may reasonably be that we know more than formerly about how people act and why they will act in certain ways.

. . . A really penetrating psychology must eventually say something about the ends and issues of life, since what these are, for each one of us, conditions at every point our whole organic and mental behavior. *Search for the roots of happiness and well-being is in part psychological in a literal, scientific sense.* Even such modest and fumbling progress as we have made does, I believe, make clear that correctives to futilitarianism are already at work among business leaders in the increasing number of cases where executives are saying to themselves in their closets and to the world in their deeds, that the satisfactions of life come for them through creative work. Satisfaction comes not in the struggle to create bricks and buildings but in the challenging opportunity to build and to lead organizations of human beings who in turn can grow and create and find new satisfaction in and through the work of the world as one normal and genuine channel of self-fulfillment.

QUESTIONS

1. So far as you can determine from the literature, what are the principal mental and physical traits of leaders in all walks of life? Which of these are essential or determining influences?
2. Name the major limitations which the average leader would be apt to have as a result of his position.
3. Should the qualities of leaders vary with the functions discharged; i.e., should each position in the organization have different requirements?
4. How does the engineer's practice in dealing with personnel problems often differ from his method of dealing with technical problems relating to materials? Is this difference necessary?

CHAPTER XVIII

DISTRIBUTING THE PRODUCT

The goal of industry is not finished until it has placed its manufactured goods in the hands of the consumer. This is a far from easy task in the complicated network of modern economic life. The consumer must be told in some way what you have to offer. The two commonest vehicles for making this announcement are advertising and salesmanship.

All the resources of modern experimental psychology can be brought to bear upon the problem of distribution with results just as notable as in the case of productive efficiency. Analysis shows that successful salesmanship starts with the wants or needs of the buyer and follows through his mental processes in arriving at a particular commodity to satisfy his wants. The salesman skillfully directs the thinking so that the buyer's need is associated with the seller's goods. This high type of salesmanship has come to be described as "*honest service* to a buyer in terms of his *needs* so that he will feel *goodwill* and be *permanently satisfied*." The earlier psychology of selling gave us the steps or static cross-sections of the selling process, but modern dynamic psychology has done much to explain the mental processes themselves and indicate the factors controlling them. The success of advertising in our day is due as much to a recognition of the psychological attributes of the buyer as to the refinements of composition, commercial art, and typography.

Economy of effort is the keynote in advertising as in production. With a fixed sum at his disposal for marketing purposes, the manufacturer often needs to know which of two alternatives will win him the greater number of customers. The scientific valid procedure here consists in arranging for preliminary try-outs. Suppose an automobile dealer wishes to know which of two illustrations will win the larger amount of public approval for his product. A group of subjects, truly representative of the consuming population to which he is appealing, would be assembled and asked to give their votes.

If 75 out of 100 favor cut A and only 25 cut B, it is reasonable to suppose that the goodwill of the unknown general public would be more certainly won by the use of the first illustration.

If one were comparing the attention or memory value of advertisements, recourse may be had to objective measurement. The two copies are placed in a large dummy booklet containing other advertisements, and the reading time controlled by the experimenter. After an interval, a similar booklet containing the original advertisements (mixed among some new ones) is presented to the subjects with instructions to identify the ones seen before. Providing no complicating factors have entered, the percentage of correct identifications enables one to compare the advertisements as to their memory value.

The field of advertising psychology is vast and has already rendered extremely valuable service to publishers and distributors. Many of the findings are of a high degree of precision. For example, a fairly well attested generalization, known as Strong's Law, states: The attention value of an advertisement, other things being equal, increases as the square root of the magnitude of the space occupied. Thus, if 100 returns are received from a half-page insertion, how many can one expect from a full-page advertisement? Not twice 100 but rather $100 \times \sqrt{2}$ or 141.

The work of personal selling should be viewed as complementary to the advertising campaign. Psychological information in salesmanship is much less extensive than in advertising, largely because experimental set-ups are more difficult. Certain things, however, are clear. The selection and training of salesmen is the heart of the problem. While selling interviews can be standardized, they must be left flexible enough so that a good salesman can take advantage of individual differences as they arise. Most lists of the qualities which managers desire of their salesmen would make them appear like paragons of human excellence, when, as a matter of fact, only a few qualities are associated with success in selling. Salesmen are as a class taller than the average prospect, which presumably inculcates a submissive attitude in the buyer. However, within salesmen as a group there is no connection between height and sales commissions. Intelligence and schooling seem to be of secondary importance for most selling positions, but an expan-

sive, socialized, extroverted constitution is undoubtedly an asset.

Some one has suggested that the psychologist ought to give instruction in how to resist selling influences, rather than aid in making an already powerful instrument of distribution more effective. There is plenty of sense in this remark. Possibly an understanding of the mechanism of forceful salesmanship constitutes the best protective against it! Here, as in all other cases, psychological knowledge is at the disposal of all who have the will and the ability to use it. As a codified body of fact about human nature, it must be neutral in its allegiances if it is to maintain its integrity as a science.

A. Principles Fundamental to Salesmanship and Advertising

1. *Stages in the Mental Stream of the Buyer*

H. D. Kitson, *The Mind of the Buyer*, 3-6 (The Macmillan Co., 1921)

Successful selling demands the psychological point of view. A sale is an interaction between two people who are exchanging economic goods. This interaction consists of a series of changes occurring in both buyer and seller. The latter makes certain moves which call forth responsive movements from the former.

The moves made by the seller may consist of various things: display of goods; verbal descriptions; pictures; even the proffer of a friendly cigar. The responses of the buyer may be equally variable: entering a store for a box of candy displayed in the window; reaching into the pocket for a coin; sending for a catalog; dispatching a written order.

In the light of such variable conditions we must recognize as forms of selling: advertising, window display, sales correspondence, and personal salesmanship. Although each of these modes of selling has its peculiar problems and methods, all have one aim in common—to influence the mind of the buyer. Any seller, then, who wishes to be successful, must study the mind of the buyer—in other words, must take the psychological point of view. . . .

The mental stream of the buyer may be divided into six stages:

I. Attention
II. Interest
III. Desire
IV. Confidence
V. Decision and Action
VI. Satisfaction

Stage I II III IV V VI

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Fig. 1. THE STREAM OF THOUGHT IN A SALE.

The order just mentioned may not be strictly adhered to in every sale. For instance, confidence may precede desire and even interest; interest may come simultaneously with attention. Generally speaking, however, the order given above will truly represent conditions, especially in the initial purchase of an article.

2. *Analysis of a Purchase and the Buying Formula*

E. K. STRONG, *The Psychology of Selling and Advertising*, 14-18 (McGraw-Hill, 1925)

The mental processes involved in a purchase when reduced to their simplest elements are: (1) Want, (2) Solution, (3) Purchase.

Mrs. Carter wants to wash the clothes tomorrow. To do so she must have soap, and as she has very little, she orders more.

She orders Ivory Soap because she has found it *satisfactory*. If it had not been so, she would have tried something else. Because the outcome of the purchase determines whether there will be a repeat order or not, and because today nearly all selling organizations are interested in repeat orders, it is necessary to add a fourth element to our analysis of a purchase. The four elements are, then: (1) Want, (2) Solution, (3) Purchase, (4) Satisfaction.

The Solution.—Whenever a want is felt it means that the individual is confronted with some difficulty or is conscious of a deficiency of satisfaction. In the world of selling and buying the solution to such a difficulty will always be some commodity or service. And the commodity or service will be somebody's commodity or service. Mrs. Carter, for example, starts to satisfy her want to have clean clothes by purchasing soap flakes, and definitely buys Ivory soap flakes, not Lux.

In purchasing, then, the element "Solution" involves always two parts: (*a*) Commodity (service), and (*b*) Trade name.

In order to have a terminology here that will fit every case of purchasing, the term "trade name" must be stretched considerably. It will be used to cover such cases as the buying of Ivory, not Lux; of buying sugar from Hawkins', not Sanders' store; and of buying tea from Smith who calls at the door, not from Jones. In other words, the solution to any want that is satisfied through a purchase always involves buying a commodity and, moreover, buying some particular company's or store's or salesman's commodity.

It is useful to be able to express the elements entering into the process of buying in the form of a diagram or formula. It helps greatly in remembering them. But any formula which represents

mental processes is inadequate and tends to misrepresent the facts. This must be frankly recognized at this point in the development of the subject. In the discussion that will follow a fuller and more accurate treatment of the subject will be made.

In buying anything, the purchaser proceeds mentally from want to commodity, to trade name, then purchase; and, upon using the commodity, he experiences satisfaction or dissatisfaction. This can be represented as follows:

$$\text{Want} \rightarrow \text{Commodity} \rightarrow \begin{matrix}\text{Trade name}\\ \text{Retail store}\end{matrix} \rightarrow \text{Purchase} \rightarrow \begin{cases}\text{Satisfaction}\\ \\ \text{Dissatisfaction}\end{cases}$$

This formula covers the elements involved in buying where a definite buying habit has been established. Thus Mrs. Carter no sooner felt the want of groceries for the day's menus than she wrote down, "1 pound butter, 1 dozen eggs, 5 pounds sugar" all of which she telephoned the grocer in a few minutes. So also she wrote down, "can of Grandmother's peas and Eddy's currant jelly," as soon as she thought of lamb.

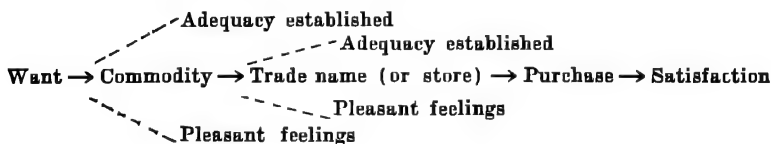
But the above formula does not yet contain certain elements that are involved whenever a habit of buying is not fully established or is interfered with by competing habits. For example, Mrs. Carter has been receiving Aunt Hannah's bread which is not satisfactory because it is "too crumbly for toast." And so Tiptop bread is ordered. Aunt Hannah's bread, to repeat, does not adequately satisfy Mrs. Carter's wants. She is changing to Tiptop because she believes it will more adequately satisfy her.

Consider another example: Mrs. Carter has been using Ivory flakes in her washing machine. A recent caller, Mrs. Mills, has recommended another soap in preference to Ivory flakes because the latter does not "get the dirt out." Her remarks have weakened the habit of buying Ivory flakes. And so when Mrs. Carter now starts to write down Ivory flakes she must decide whether she will or will not buy it. Reasons flash through her mind attacking Mrs. Mills' objection and also supporting her own use of Ivory. Had she absolutely no reasons to give herself in defense of her established habit of buying Ivory, the chances are that she would try Mrs. Mills' soap.

In buying it is frequently necessary that reasons be advanced in support both of the commodity and of the trade name. And it is also necessary, possibly even more essential, that a *pleasant feeling* shall be experienced when the commodity and the trade name are thought of. Lava soap is bought for the garage because it removes

grease better than any other that has been tried (reason), and Palmolive soap is bought for the bathroom because of a liking for it (pleasant feeling). The action in the latter case cannot be defended in terms of reasons because it is known from using other soaps in hotels and at the homes of friends that Palmolive is not the only soap that will clean easily. But the purchaser likes it so much that he unconsciously asked for Palmolive shaving cream one time when he needed this commodity. Again feelings came into play. The shaving cream was all right but the purchaser didn't like the color scheme of the tube, so he hasn't bought any more.

To insure purchase the commodity must be considered adequate and also pleasing. In a great many cases if the commodity is viewed as adequate it is also liked, and vice versa. But this is not always the case. There are some objects which have been found quite adequate but which are not liked, and there are some things that are liked and bought which are admittedly not so good as other competing commodities.

When adequacy and pleasant feelings are included in the buying formula a diagram like this is the result:

When a buying habit is being established it is necessary that the buyer shall be able to give himself reasons as to why the commodity is an adequate solution to his want and as to why the particular trade name is the best one to buy. It is also necessary that he shall feel pleasantly toward the commodity and the trade name.

And whenever his buying habit is challenged by a friend's remark, a salesman's presentation of a competing article, or the statements in an advertisement, it is essential that the buyer shall have reasons with which to defend his action, and that in addition he shall feel pleasantly toward both the commodity and the trade name.

All this is represented by the dotted lines in the formula. To repeat; whenever the commodity is questioned, as, for example, whether concrete or brick will be used in building a sidewalk, the reasons and feelings that come to mind determine the choice. And whenever the trade name is questioned—whether Ivory or Palmolive shall be used—the reasons and feelings that come to mind

again determine the choice. Consequently, when a person is being influenced to buy, not only the first time but also later on, it is important, whenever he hesitates, that reasons for buying both the commodity and the trade name shall be ready to his need and that he shall be conscious of a pleasant feeling tone in both connections.

3. *Meeting Human Demands*

A. T. Poffenberger, *Psychology in Advertising*, 63-65 (McGraw-Hill, 1925)

The recent history of the Franklin automobile offers an excellent illustration of the functioning of the two antagonistic desires of self-assertion and submission. Some years ago the Franklin engineers designed a car whose lines should be such as to offer the least air resistance and at the same time be beautiful. In appearance it was distinctly different from the other cars in its class. The car happened to appeal to the great class of buyers where conformity was the ruling influence, where as patterns changed from year to year the buyers were sure to follow. This need of conformity did not permit of too great difference in appearance. The design of the car, especially the hood, was apparently changed to its present form in order to conform more nearly to the shape of other cars of its class. In extremely high-priced cars great difference is a distinct asset; it sets the owner off from others as he wishes to be set off. In the moderate priced cars great difference is a liability, it marks the owner off too sharply from those with whom he needs to conform.

This need to change and need to conform keeps markets active that would otherwise be dull. It is present not only in the ownership of clothing, jewels, and automobiles; it is just as evident in the kinds of books that one reads, in the kinds of spectacles that one wears when one reads the books, in the styles of homes and their furnishings, even in the location of these homes. The advertiser who sells conformity where it should be sold and difference where it should be sold will have a ready market for his goods, and it makes little difference whether he deals in face powder or country estates.

4. *Training Salesmen*

H. G. Kenagy and C. S. Yoakum, *The Selection and Training of Salesmen*, 300-301, 314-316 (McGraw-Hill, 1925)

Next to the selection of salesmen, the training of the men selected has been the most important personnel problem for the sales manager. Gradually, opinion has swung around from the

belief that all salesmen are born, not made, to the hope, at least, that training can build a competent sales force. Undoubtedly there is a modicum of truth at the base of the old belief, for it has been proved that salesmen as a class differ from others in natural interests and aptitudes. For example, sales engineers can be differentiated from design engineers by their interest in people rather than things, their dislike for painstaking and long-continued application to detailed work, their accumulation of general information not concerned directly with their work, etc. Salesmen are usually opinionated and seek to convert others to their views. They are not self-conscious or retiring in disposition. Undoubtedly many of these characteristics are present as a result of boyhood environment and training, but this social inheritance is as strong as natural or biological inheritance and amounts to the same thing so far as the problem of selecting salesmen is concerned. The individual with the natural traits which are important in selling has a great advantage over the man who is not attracted to selling by the possession of such traits.

But, when this is said, it still remains true that training is far more important to successful selling than ever before. The old belief that salesmen and other leaders were born, not made, retained its vogue so long because no one had analyzed the problem into its elements and succeeded in reducing these to a series of readily understood principles. The change in emphasis during these later years is due partly to the fact that salesmanship has been greatly changed in method and, therefore, in the qualities needed for success, but more to the fact that the beginnings of analysis have been made and some of the elements needed for successful selling are known. We now know that natural gifts need to be exercised and trained. Born salesmen may exercise and develop their gifts unconsciously, but average men must do so knowingly and preferably with guidance.

In the old days a salesman was supposed to be able to sell anything; he used the same selling tactics for all commodities. He was famed as a story-teller; he talked glibly and in glittering generalities; he exhibited samples with dramatic flourishes; he bribed buyers with cigars, dinners, and free goods. Today this type of selling has all but disappeared. In its place has come institutional selling. The salesman of the new order knows his goods thoroughly and knows the services they will perform. He to learn how to meet their needs and desires, but he sells his goods knows his company, its sales and service policies, and he must be their living embodiment. He studies his prospects and customers on their merits. He need be neither the hail-fellow-well-met type

nor a good mixer. He must be able to inspire confidence and secure respect. At once it appears that, instead of requiring a single type of salesman, business today requires many types, as many as there are distinct classes of products. One writer has gone so far as to assert that when any sales organization has developed a distinct sales and service policy and is trying to sell itself as well as its product, it needs to develop its own institutional salesmen.

If salesmen need to know their products and how to demonstrate their merits to prospective purchasers; if they must be able to show such buyers how the product fills certain needs in their business; if they must develop throughout their territories a respect for and appreciation of the company and its business methods; if they must do these and other things of great importance, it is clear that they must be far better equipped for the tasks than nature and circumstances have provided. Training becomes at once a problem of central importance in the work of developing an effective sales organization. . . .

First, selling personality is the effectively operating sum of certain qualities. A successful sales personality is one which has at least the following qualities. It desires:

1. To interest customers
2. To be courteous
3. To be friendly
4. To be patient with disagreeable customers
5. To control the temper
6. To learn the names and faces of regular customers
7. To find out quickly the needs of the customers
8. To inspire confidence and to be convincing
9. To display goods intelligently
10. To know how much to talk

To these might be added many others, but the foregoing are sufficient for illustration. If we add these qualities together we shall not have a complete picture of a sales personality; because there is always some intangible spiritual element behind it all; though perhaps, with patience, we might be able to list all possible qualities whose sum is personality. But of one thing we can be certain: that salesman has a fine personality who is courteous, displays his goods intelligently, and closes the sale artistically.

The second principle runs as follows: Sales personality is best improved by developing qualities one by one. If a hunter is to bring home a bag of game, he cannot fire at random; he must aim at the birds one by one. A business executive must attack

his problems one after the other. A poor salesman must be improved quality by quality. Inspirational talks about doing better do not get far. The qualities must be separated and each one developed one at a time.

This is the point at which personality training has markedly failed. Perhaps because we have thought that we cannot define personality, or think it cannot be developed, we have failed to list the qualities, and failing so to do, we have let nature take its course. If we see salesmen improve we are glad; if they do not improve we say that it cannot be helped. If, however, we believe that it grows quality by quality, as brick by brick the house rises from its foundations, we are at once in a strong position, because it is easily possible to handle one quality at a time.

The third principle is this: To find out how to improve a quality of selling personality, ask the best salespeople how they have developed the quality. We have depended too much upon books on selling. They are too theoretical and too general. They tell only what to do when salespeople want to know how to do it. They say: Be courteous, inspire confidence, or display goods intelligently! That merely tells what to do. But the salesman wants to know how to be courteous, and how to display goods intelligently. On this point, the books are silent. But the people who sell know, and they can tell you exactly what to do. One salesperson may not know, but thirty always have the answer.

The good salesmen are a gold mine of information. There is enough information in the heads of the best fifty salesmen in a company, all ready for use, to supply a training program for the whole selling force for 10 years. It is hidden away and never talked about. All that is necessary is to draw it out, put it on paper, and make it available for use by everybody. It is not necessary to go outside the business to get all the information that the most exacting instructor could want.

Some fifty-three qualities such as those listed above are presented to salespeople according to the following plan:

1. Select seven to nine questions such as "What do you do and say to show customers that you are interested and courteous?" If more than nine questions are presented the salesman grows tired toward the end of the interview and does not give as full answers.

2. Have someone in the firm pick out thirty of the best salesmen. Sometimes this is done by the sales manager, at other times by his assistant, and at still other times by two or three people in conference, as the division manager, the district manager, and the

supervisor. The people selected are always partly composed of those who have been or are good salesmen.

3. The questions, mimeographed, are distributed to these thirty salesmen. The sales manager explains their purposes and states that someone will soon interview them to get them to talk about the question and that all they need to do is to think about the questions and talk when the interviewer visits them.

4. Interviewers are trained. These consist of graduate students and special assistants in the field work. They are taught to bore into the experience of the salesmen and particularly to ask continually: "*How* do you do this?" Illustrations are requested. Sometimes if the salesman is told to think of what he would tell a beginner, he is helped. As the salesman talks, the interviewer writes as rapidly as possible, being particularly careful to record picturesque and forceful expressions.

5. After the interview, which usually is 45 minutes, but varies with the interviewer and the person interviewed from 30 to 75 minutes, the material is written up. This takes usually about 40 minutes. In writing up, a number of mechanical devices have been found useful. Each question is written on one page, so that all the thirty answers to each question can later be thrown together.

6. These answers are then taken and worked up question by question. The thirty are read by the compiler, headings decided upon, re-read and classified, and then written in final form. From 3 to 5 hours are necessary for the compilation of the answer to each question.

7. The compilation is then mimeographed. Copies are given to those interviewed and additional copies are available to be used in training the salespeople.

B. Determining the Effective Advertisement by Experiment

5. *Belief and Reasoning*

A. T. Poffenberger, "The Conditions of Belief in Advertising," *Journal of Applied Psychology*, 7:1-4, 7, 9, (1923)

1. Belief is rarely the result of reasoning. One does not go through the processes of logic to establish his beliefs. If logic is used at all it is to justify a belief already established. A striking illustration of the separation of reasoning and belief is found in the case of the insane patient who firmly believed himself to be the son of a king, and yet whose reason was intact enough to enable him to solve complicated mathematical problems.

The advertising of the New Gillette razor offered a good oppor-

tunity for studying the relation between belief and reasoning. On May 16, 1921, the Gillette Razor Company announced "a new triumph of American inventive genius of startling interest to every man with a beard to shave." The advertisements state that the "fulcrum shoulder, overhanging cap and channeled guard" were the three innovations which made possible "for the first time in any razor, micrometric control of blade position." A diagram showed "how the blade is biflexed between overhanging cap and fulcrum shoulder. It is flexed once into the inside curve of the cap. This is the minor flexure—the curve for easy gliding action and play of the wrist in shaving. It is flexed a second time—more sharply and in a shorter radius—by the grip of the overhanging cap the whole length of the fulcrum shoulder. This is the major flexure." This arrangement provided an exactness of adjustment to 1-1000 of an inch. Advertisements containing the above information and well illustrated were given to fifty-seven men, college students and university graduates, together with a series of seven questions intended to test both their belief in the new razor and their understanding of it. The answers to these questions showed that all the students agreed that the new razor was better than the old one, and that they would rather pay $5.00 for the new one than $1.00 or $2.00 for the old one. In supporting their belief they were allowed to consult the advertisements as much as they wished. They quoted the "fulcrum shoulder, overhanging cap and channeled guard," which made possible "micrometric control of the blade position," but not one of them could explain how the micrometric control was obtained or what advantage there would be in having such micrometric control. They believed that the "channel guard" was an improvement although they could not tell why it was an improvement. As to the importance of major and minor flexures they were entirely ignorant. Five minutes examination of an enlarged diagram of the new razor improved their understanding of the razor little or not at all. Here is a belief effective for the purpose of the advertiser in spite of the inability of the reader to support his belief with reason. This experiment is quoted not to show that the advertisement is poor, but merely to show that in advertising reasoning is not needed to create belief. Whether the space in the advertisement devoted to argument might have been more profitably filled, is however an interesting question.

2. It is not necessarily that which is true that is believed. The fact that a statement in an advertisement is true will not guarantee belief on the part of the readers of it. The truth may be too startling and surprising to be believed, and in some cases it might

be more effective to tell half the truth than the whole truth. Three advertisements were chosen for investigation in this connection, each of them presenting rather unusual information. In each case the truth of the statements made was vouched for by reliable individuals. Each of the advertisements was presented to 100 people, together with a series of statements about them. The individuals were to simply check those statements that most nearly represented their opinion about the advertisements. The statements were carefully prepared so as to avoid suggestion. The studies of the three advertisements will be reported separately:

Taylor Trunk Advertisement.—This advertisement showed the photograph of a huge elephant standing on a trunk. The picture was accompanied by a signed statement as to the genuineness of the photograph, and by statements to the effect that the trunk was taken from the regular stock. Statistical treatment of the replies of the persons tested showed that 38 per cent of them doubted the truth of the statements made in the advertisements; 24 per cent questioned the genuineness of the photograph; and 21 per cent believed that it would be impossible to construct a trunk strong enough to withstand such a weight. That is, in from one-fifth to two-fifths of the persons tested the advertisement created a state of mind adverse to the purchase of the article.

Stanley Vacuum Bottle Advertisement.—This advertisement represented a vacuum bottle falling from a high window, and described an incident in which a Stanley bottle had accidentally fallen from an eighth-story window and suffered only a dent, which did not at all interfere with its usefulness. The replies to the questions submitted with this advertisement showed that 31 per cent doubted the truth of the statements, while 22 per cent refused to believe that a vacuum bottle sufficiently strong to survive the fall could possibly be constructed.

Edison Phonograph Advertisement.—This advertisement pictured one of the well-known "tone tests" demonstrations in Carnegie Hall, Pittsburgh. It showed the stage occupied by a well-known singer and an Edison phonograph, with the audience in the background. On the advertisement there were reproduced a number of clippings from the daily papers describing the remarkable demonstration, each clipping making the statement in one form or another that no one in the audience of 2,600 people could distinguish between the voice of the singer and its reproduction. Replies from 100 people to eight questions about this advertisement may be summed up as follows: 77 per cent doubted the truth of the statements contained in the advertisements; 73 per cent believed that they could tell the difference between a real voice

and its reproduction by any phonograph; 82 per cent believed that mechanical sounds would betray the phonograph in these "tone tests"; 49 per cent believed that some form of trickery or deception was practiced; 50 per cent believed that the artist intentionally imitated the phonograph; 44 per cent believed that a specially constructed phonograph was used for the demonstration rather than a stock instrument; 68 per cent believed that no phonograph could successfully undergo such a test; 39 per cent stated that an actual demonstration of the "tone test" such as that described in the advertisement would not convince them of their inability to distinguish between the human voice and its reproduction.

This advertisement seemed especially effective in failing to create belief in the minds of its readers, when over three-fourths of them doubted the truth of the statements. The writer recommended in this case a less extreme and less startling form of appeal which should not arouse the antagonism manifested in this experiment.

Thus far the negative side of the question has been presented. If belief in an advertisement does not depend upon the truth of the statements made and does not depend upon the reasoning of the reader, on what does it depend? To state the matter simply, we may say that ideas which are present in the mind and are not interfered with by any opposing ideas will be believed. This is merely a bare statement of the law of suggestion and to comply with it in advertising, conflicting ideas should be prevented from entering the mind. There are many conditions on which such undisturbed acceptance of ideas depends. Only three will be mentioned here.

1. The ideas aroused by an advertisement must not conflict too sharply with the reader's experience. Introspections volunteered by many of the 100 subjects who served in the experiments just described indicated that their past experiences with trunks, vacuum bottles and phonographs furnished conflicting ideas which the advertisements were not sufficiently powerful to overcome. This was especially true in the case of the phonograph advertisement where doubt was expressed in a large percentage of the cases. . . .

2. Ideas that are to create belief must come from an authoritative source. This is a well-known law of suggestion. The hypnotist can do nothing without his air of authority and the subject's recognition of it. We are accustomed to believe the statements made by a person in whom we have confidence, and to believe what is printed in a medium which we consider authoritative. Even if there is conflict with one's own experience, he will sometimes accept

the contrary experience of another person as a basis for belief if he have sufficient confidence in the other person. But even then the new experience may not be too conflicting.

3. There is a third important condition of belief, namely, that we tend to believe what arouses our desires, our fears and our emotions generally. I have no experimental evidence to offer in this connection, and know of none in the field of advertising. But evidence for the importance of this factor may be drawn from psychology. William James has said, "A man who has no belief in ghosts by daylight will temporarily believe in them when alone at midnight, he feels his blood curdle at a mysterious sound or vision, his heart thumping and his legs impelled to flee."

6. *Attention Values of Pictures and Color*

H. K. NIXON, "Two Studies of Attention to Advertisements," *Journal of Applied Psychology*, 9:176-178, 183, 187 (1925)

The experiment from which the present results were secured may be briefly described. In general it consisted in representing two advertisements simultaneously, one advertisement possessing the feature whose attention value was being tested, and the other not possessing this factor, and observing the length of time the subject looked at each advertisement. It serves as an objective approach to problems of attention which have previously been attacked by less direct methods.

The subjects of the experiment were 30 in number, consisting of business men, housewives, and students in Columbia University, 14 men and 16 women. The age range was from eighteen to fifty. In the first experiment here reported thirty-four advertisements having pictures of people and thirty-four having pictures of objects were paired. In the experiment on color forty-four colored and forty-four black and white advertisements were paired. In the first case the factors of position (right or left hand page), color, size of illustration, possession of border, and degree of complexity were kept in balance, so that the pictures of people appeared half of the time on the left hand page, half of the time with color, and so on. In the case of the color experiment similar care was taken. All of the advertisements used were full page, of *Saturday Evening Post* size. They were bound together in a book of which the subject turned the pages. For the part of the experiment dealt with here the subject spent thirty seconds on each pair, distributing his time between the members of the pair as he was inclined. Unknown to the subject the observer recorded the distribution of eye fixations and the following pages present

the tabulation of the data thus derived in the case of pictures of people and of color.

I. *The Use of Pictures of People as an Attention Factor in Advertising.*—The practical advertising man has always recognized the value of illustrations of people as a method of attracting attention. A survey of current magazines shows that over 65 per cent of full page advertisements contain pictures of humans as a prominent feature, and it is probable that this use is on the increase. Academic psychology has likewise noted that people are prepotent factors in attention. As far as the writer knows, no study has ever been made to determine with exactitude the real efficiency of illustrations of people. Hollingworth has, indeed, cited an experiment showing that persons and faces are more easily remembered than objects and he has stressed the value of suggested activity, which is likely to be the activity of humans. Aside from this, the topic seems to have been neglected. As the data here presented will indicate, this neglect is serious, for in any experiment on advertisements one might almost as well neglect size or position and might better neglect color or border or size of display type than to neglect this factor. It is therefore, both from the point of view of the advertiser and that of the experimenter on advertising material, of importance that definite data be secured on this subject. The figures presented in this article are suggestive of what may develop.

The data of the original experiment of which this work is an elaboration indicated that subjects, in a surprisingly large number of cases, tend to first turn the eyes to advertisements having pictures of people in them, as opposed to advertisements having only illustrations of objects. For convenience the original figures are reproduced in Table I.

The original data also showed that pictures of people maintained a decided interest throughout the period of exposure.

TABLE I

First Fixations out of Possible 34 (Thirty Subjects)

	Average Number	S. D. av.
34 advertisements with pictures of people......	18.93	0.48
34 advertisements with pictures of objects......	15.07	0.48
Difference = 3.86	S. D. diff. = 0.96	

II. *The Attention Value of Color in Advertisements.*—Franken and Hotchkiss found that colored advertisements had a 13 per cent greater recognition memory value than an ordinary black and white page. Kitson reports that the use of color is greatly on the increase since 1912. These two investigations are practically the only ones available on this important practical question of the value of the use of color as an attention device. The impression is widespread that color is very effective and millions of dollars are spent every year under the idea that if the advertisement is only given color it is sure to dominate its black and white competitors.

Our experiment shows that color is surprisingly inferior in attention power. Even in attracting initial attention, for which it is ordinarily used, it is not nearly as effective as pictures of people. What initial advantage it does possess it loses very rapidly, so that after ten seconds the black and white competitor comes to be slightly superior. Color does, indeed, show considerable memory value, about that found by Franken and Hotchkiss, but in general the use of color as an attention device under modern advertising conditions would hardly seem to be warranted when one considers the great extra cost. The truth is, perhaps, that not color as such but difference or novelty or change are the basic attention factors and in a magazine where colored advertisements prevail any one advertisement need not expect to profit especially in the way of extra attention. This does not invalidate its use for artistic purposes, of course, and from this point of view color may well be worth all it costs. It is likewise probable that in media where the use of color is infrequent its utility may be greater, as may also be the case where it is employed in some unusual or startling manner. In general we would merely urge here that it should not be too blindly accepted as a potent attention device.

7. *Answering a Question of Marketing Efficiency*

E. K. Strong, Jr., *Habits of Passengers in Street-Cars, Elevated and Subway Trains as Regards the Reading of Advertising Cards*, Report No. 3, Association of National Advertising Managers (1913)

The present investigation had a two-fold purpose:—(1) of studying the habits of passengers in the matter of reading advertising cards, and (2) of comparing the efficiencies of subway, elevated, and street-car advertising. The first part has been fairly well worked out. . . .

Two different methods were employed in securing the data. The first method consisted in watching a group of passengers in a car

during the ride from one station to another, that is, during a period of about two minutes. One-half or one-fourth of a car was considered at a time. The following factors were noted:

(*a*) Number of each sex (children were recorded separately from adults)
(*b*) Number standing and sitting
(*c*) Number reading newspapers, magazines, books, etc.
(*d*) Number looking at the advertising cards displayed in the cars

The data were so noted down that any combination of the four factors could be reported, as, for example, the number of women who stood and read a newspaper or who were seated and looking at ads. . . .

The data from the first method will be presented. . . .

The following data are based on observation averaging approximately two minutes in duration:

1. The Subway. The data were all gathered on the Broadway division of the Subway, between Dyckman St., Manhattan, and Atlantic Ave., Brooklyn. Passengers include only those standing or seated in seats running lengthwise of the car. (A small amount of data from passengers seated in the crosswise seats, now discarded by the system, showed clearly that such individuals do not look at advertising-cards anywheres near as much as those seated in lengthwise seats. These data are not included here.)

Table I gives the total per cent of men sitting and standing and the per cent of those who read newspapers, etc., and those who looked at ads. The same information is given for women. (It should be emphasized here that the number standing is not comparable with the number sitting because for the most part of the investigation the former were ignored. It was only during the last fourth of the study that they were included and then not always. Those standing move about so much that it is well-nigh impossible to keep track of them. Indeed, it is impossible when the car is jammed. The figures that are given are accurate, however, as far as they go.) The time of day is divided into four parts. The first part represents the early morning rush, the second period covers the middle of the day, when generally speaking, there is a seat for every passenger, the third period covers the evening rush, and the fourth period covers the evening traffic. Totals for the entire day are given in the last column of the table.

Conclusions from Table I.

1. Three times as many men read newspapers, etc., as women.

2. The percentage of those reading decreases as the day advances, except for those standing, where the evening rush period

shows a greater proportion reading than during the middle of the day.

3. Fifty to 75 per cent more women look at ads than men.

4. The per cent of both men and women who are seated and look at ads remains constant throughout the day,—15 per cent of the men and 21 per cent of the women.

TABLE I

SHOWING RESULTS FROM SUBWAY, EXPRESSED IN PERCENTAGES OF THE TOTAL NUMBER RIDING

	Time of Day				Total
	7-10 A.M.	10-5 P.M.	5-7:30 P.M.	7:30-11:30 P.M.	
Men					
Sitting					
Number riding	1,445	2,294	909	1,973	6,621
Per cent reading	58%	41%	39%	28%	41%
Per cent looking at ads	15%	14%	13%	16%	15%
Standing					
Number riding	117	319	177	193	866
Per cent reading	33%	21%	26%	10%	22%
Per cent looking at ads	5%	19%	10%	24%	15%
Women					
Sitting					
Number riding	646	1,433	518	1,005	3,602
Per cent reading	24%	12%	14%	8%	13%
Per cent looking at ads	23%	21%	21%	20%	21%
Standing					
Number riding	39	67	42	44	192
Per cent reading	8%	4%	14%	2%	7%
Per cent looking at ads	10%	39%	21%	25%	26%

5. The percentages of men and women who are standing and look at ads are not so reliable as they might be, due to the few cases observed. On the whole, it appears that as the day advances the percentage of those looking at ads increases. This increase on the part of the men is paralleled by a decrease in the number of those reading newspapers. The average for the entire day is 15 per cent of the men and 26 per cent of the women.

C. Abuses in Advertising

8. *The Testimonial Business*

STUART CHASE and F. J SCHLINK, *Your Money's Worth*, 24-25 (The Macmillan Co., 1927)

Do you buy because Babe Ruth or Red Grange or the Queen of Roumania endorses a product—with full length portrait and signed testimonial? Note well the following circular from an advertising agency which gives a hint of the machinery which lies behind the copy:

For those of your organization who require testimonials or special posing of moving picture players, operatic or theatrical stars, famous athletes, society people and other famous personalities, there is made available a new service called Famous Names, Inc., Chicago. (Branches in New York City and Hollywood, Cal.)

The fee for the exclusive use of a star is between $150 and $2,500, depending upon the standing of the star and the length of time the exclusive use is desired. This fee includes the special posing and signed indorsements. The rights to use this service are sold on an exclusive basis, which means a definite protection to the advertiser against duplication in picture, names and indorsements. The rights are directly assigned to the purchaser, signed by the star, and assignment is also made by Famous Names, Inc.

Millions are daily attracted to moving-picture theatres because of the popularity of the names and pictures of these stars. Likewise, *additional* millions can be attracted to national advertising through the use of pictures of these stars who are familiar and popular with the buying public.

The picture of a famous star will always attract copy attention!

A large New York advertising agency received the following form letter:

Promotion Director

DEAR SIR:

The writer will be glad to consider arranging for endorsements of commodities or products of national reputation from Her Majesty, the Queen of Roumania.

Please let me know by November 21st if any of your clients are interested.

Yours very truly,

H. C. KLEMFUSS, *President*

This was at the time of the visit of the Queen to the United States.

9. *Exploitation in Business*

F. H. ALLPORT, *Social Psychology*, 408-409 (Houghton Mifflin, 1924)

The aim of the business man is to increase his business; that is, to induce people to buy his product or service. The very nature therefore of business implies a ceaseless and varied endeavor toward social control. The salesman and promoter employ the art of oral suggestion, enforcing it by assuming an ascendant, face-to-face attitude and by thrusting their prospects into the submissive rôle. Personality traits thus attain great importance in the selection of selling personnel and in the social contacts involved in selling.

Advertising is a form of control which has assumed gigantic and wasteful proportions in modern business. A more socialized ethics than that which the business class has evolved is necessary to curb this growing evil. Every form of appeal is employed in order to coerce individuals to buy. Protection from injury or impending disaster, sex, humor, hunger, pleasures of the palate, love of wife and children, the social self-attitude, caste, social conformity, patriotism, and even love and respect for one's mother are all played upon to induce the purchase attitude and fill the coffers of the profiteer. These appeals are conditioning stimuli for the arousal of prepotent responses in a manner conducive not to the socialization or efficiency of the consumer but to the gain of a limited class of commercial men. Human nature is thoroughly exploited.

Advertisers do not limit themselves to control through the fundamental activities. They capitalize many other laws of social behavior. The buyer is controlled by verbal and pictorial suggestion. His submissive and conforming attitude is evoked through creating an impression that a large number (which to the unthinking individual means 'every one') is buying the product. Suggestion is further increased through quotations from individuals in authority, or through social and financial prestige. Attitudes of compensation for inferiority in physique, education, wealth, and social status are freely exploited.

Such advertising involves not only unjustifiable exploitation of the human drives, but artificial stimulation of demand, wasteful establishment of consumptive ideals, and competition in extravagant styles and luxuries. Discontent and envy among the poorer classes are a further result of these enticing but expensive appeals. It is true, of course, that not all advertising merits the above criticisms. Some firms do not advertise to stimulate demand or to

arouse approaching responses by irrelevant appeals; but are content merely to state the essential merits and price of their products. General culture and comfort are promoted by this class of advertisements. Æsthetic improvements have also been made (although the landscape is still disfigured by billboards). This finer sense of social values is, however, not yet shared by the majority of business houses.

D. Good-Will

10. *Four Things to Be Accomplished in Selling*

E. K. STRONG, *The Psychology of Selling and Advertising*, 96-98 (McGraw-Hill, 1925)

The aim of a selling organization is to make customers, to form in the minds of thousands of people the habit of buying a given commodity at a certain place. To do this there are four fairly distinct things to be accomplished. First, some prospective customers must be led to *buy the commodity for the first time.* Second, some prospective customers must be led to *buy the seller's brand for the first time,* instead of a competitor's brand. Third, those who have bought the seller's brand must be led to *buy it again and again.* And, fourth, those customers who are influenced by competitors must be led to *buy despite the competition.*

If it were necessary to run entirely different advertisements to accomplish these four aims, then each advertisement would only be one-fourth as efficient as it might be if each advertisement could accomplish all four at the same time. The same thing holds true in selling. If the salesman must employ four different sales procedures it will take him longer to acquire them, and he will be less efficient for a long time than if he can employ one general sales procedure.

Frankly, it is often impossible to accomplish all four aims at the same time. There are occasions when one aim must be emphasized even to the extent of ignoring the other three. The more, however, an advertisement can secure entirely new customers for the commodity, switch customers from another brand, maintain old customers, and prevent inroads from competitors, the more efficient it is, since, among the readers of any medium there are some who belong to each of these four groups. And in the same way the salesman who can sell a prospect in such a way as to make a permanent customer is a more efficient salesman than one who has repeatedly to sell the man before securing him permanently.

The prospective customer who has never used the commodity at

all must be made to feel some want and to see that the seller's commodity will satisfy it. Emphasis must be placed upon the elements on the central line of the buying formula, but particularly upon Want, Commodity, Trade Name, Purchase, and Satisfaction. As it is also necessary to show this new customer how the commodity will satisfy his want, some emphasis must also be put upon Establishing the Adequacy of the commodity and upon Pleasant Feelings associated with the commodity and trade name.

The prospective customer who has been buying a competitor's goods must be led to see that the seller's goods will more thoroughly satisfy his wants than do the goods he is buying. Here emphasis must be put upon Adequacy and Pleasant Feelings associated with Trade Name, for the new customer must have reasons why the seller's commodity is better and he must come to feel more pleasantly toward it than toward the old brand.

The established customer is one who, when he feels his want, satisfies it by buying the trade-named commodity which he has bought before. He does not think of reasons for so acting, nor does he have any particular feeling in the matter, any more than one does in the case of shaving, or starting his auto. He has a well-established habit and when the occasion occurs the act is performed. From the standpoint of maintaining the habit the most important element is that of satisfaction resulting from the use of the commodity. So long as each use of the trade-named article brings satisfaction the tendency is for the habit to continue in force.

Forgetting in such a case is guarded against by general publicity, by reminder advertising. And in reminder advertising the emphasis is upon the items on the main line of the buying formula and particularly upon Trade Name and Purchase.

The hesitating customer is one who is confronted by a competitor's claims. A salesman in the store, or at the door, or in the office, or in an advertisement suggests a new trade-marked commodity. Whether the new substitute will be bought or not depends upon the salesman or advertisement, and upon the strength of the old habit. In a real sense the habit within the old customer must fight the battle for the company. Whether the old habit will win or lose depends very largely upon the strength and the elements that compose it.

The strength of an established habit depends largely upon the number of times it has been performed, i.e., upon the strength of the associations connecting Want, Commodity, Trade Name, Action, and Satisfaction. But its strength to resist the interference of a competing seller is largely in terms of the Reasons and

feelings that will come to mind at the moment. For these reasons and feelings actually function as would a salesman if he were present to defend the old habit of buying.

11. *The Practice of Publicity*

G. C. QUIETT and R. D. CASEY, *Principles of Publicity*, 1-3 (Appleton, 1926)

As society grows more complex it becomes increasingly difficult for any large part of it to know how the other half lives, thinks, acts, or what it is trying to accomplish. It has become so difficult that industries which are among our greatest have been organized for the specific purpose of keeping the public informed. Certain activities of immediate interest to great masses of people are chronicled in our newspapers and reproduced in our motion pictures. Certain topics, because they obviously affect the immediate welfare of large numbers, are made the subject of discussion in magazines and by speakers from pulpit and platform. But certain other subjects of equal but less obvious interest and importance are often so neglected or so incompetently treated that the public has no opportunity of forming an intelligent opinion concerning them; and certain matters are presented in so biased a fashion that it is necessary to inform the public as to the merits of the other side of the question.

The purpose of publicity is to inform the public about a specific individual, an institution, or a cause so as to create a public opinion that is intelligent, informed, and favorable. Although the creation of opinion is not a problem of modern origin, the technique of publicity has recently assumed a new importance. The spread of democracy and the attendant shift of authority from top to bottom; the release, by reason of educational and economic opportunity, of new energies, ambitions, and ideals, and the increase of literacy and common knowledge among the ranks of common men; the invention of quick and efficient means of communication; and the growing complexity of our institutions, have combined to create a situation wherein the opinion of the public is a matter to be reckoned with, wherein it may be easily reached, and wherein so many things bid for its attention that a special technique is required to interest it. Publicity is that technique. *Publicity is the specialized effort of presenting to the public particularistic news and views in an effort to influence opinion and conduct.*

Publicity utilizes many media of public information, foremost of which is the newspaper. Some misconceptions concerning publicity may be cleared away by defining its relation to the newspaper:

News is current, truthful, and interesting information from the point of view of one who desires to be informed.

Publicity is current, truthful, and interesting information from the point of view of one who desires others to be informed.

First of all, publicity must be honest. And it must be responsible and aboveboard.

Current, truthful, and interesting information, written from the point of view of one who desires others to become informed, has a definite news value. And the business of a publicity man, who is writing for the press, is to disseminate to the newspapers such information, or to make it possible for the newspapers themselves to obtain it.

Publicity is commonly confused with advertising, but its requirements and its technique are quite different. Publicity appeals to enterprises which could make but sparing use of advertising if they could use it at all. Agencies of social, religious, and educational work, which have a story to tell, a story that the public ought to hear and will gladly hear if it is rightly told, cannot use advertising largely, both because of its expense, and because it is an unsuitable medium. Occasionally they can use advertising, but the day-by-day story of news events which will make them and their work known must be told through publicity.

A newspaper proprietor has drawn the distinction between advertising and publicity that publicity is merely advertising that isn't paid for, and, on the face of it, this might appear to be true. But this is a wrong conception of worthwhile and legitimate publicity. The function of the newspaper is to print the news. The function of the publicity man is to find the news for the newspaper and turn it over to the newspaper with the understanding that if it is not news it will not be printed. Newspaper editors are not deceived by thinly veiled advertisements sent in for the news columns, and such items are thrown into the wastebasket every day. But when an enterprise is able to convince the newspaper editor that its activities are of interest to his readers, and when it provides stories that can compete for space with the stories turned in by the newspaper's own reporters, or information which the reporters themselves use for stories, then the material has been raised out of the class of advertising as such, and is accepted for publication by the newspaper strictly on its merits as news. Although the institution about which the publicity is concerned owes a debt of gratitude to the newspaper editor for printing the story, the newspaper is not without its debt of gratitude for receiving a story of general interest which it would otherwise have had to get, if at all, at the cost of a reporter's time and effort.

QUESTIONS

1. What are the likenesses and differences between professional salesmanship and advertising?
2. Show how psychological knowledge can lead to a social employment as well as an abuse of the advertising process.
3. Suppose you had only a small sum to spend for advertising; would it give larger returns (1) to run small advertisements in many different periodicals, or (2) to concentrate expenditure in one large advertisement in one medium? How could you find the answer?
4. What is the function of publicity in contemporary society? How does it differ from propaganda? From advertising? From ordinary news and information?
5. Why is less resistance met when the buying formula is used by the salesman as his guide?

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